PHILIPS

AC-millivoltmeter

PM 2554

9447 025 541.1

Instruction Manual.

9499 470 15202

780412

Positive feedback

Now you are the user of a Philips test and measuring instrument. We trust that it will give you many years of faithful service. But we would like you to realize one thing: we can only supply the best in T & M equipment with **your** help, user.

We need to know what you have found to be the strong and weak points of this instrument; and we would be very interested to hear about any unusual or elegant applications you have devised for it. Some of this information can be passed on to our design and development departments; and some may be fed back to other users via our bimonthly publication **T & M News**.

May we therefore suggest that you fill in the reply card alongside and send it back to us right now. (or, - even better - make a note in your diary to fill in the reply card in say 6 months. After you have gained some experience in using the instrument in practice). That way, you'll be helping to provide the positive feedback we need to help you!

All contributions that are published will be paid for at current rates; while as an inducement for you to fill in the reply card, we are offering a free subscription to T & M News or a free copy of Part I of our Digital Instrument Course to all who reply.

Erfahrungsaustausch

Meßgeräte müssen sich in der Praxis bewähren und die in sie gesteckten Erwartungen erfüllen; auch bei Ihnen, dem Besitzer eines Geräts aus der Serie der Philips Test- und Meßgeräte. Wir aber können T & M-Geräte nur zu Ihrer vollen Zufriedenheit herstellen, wenn wir alle Ihre Wünsche kennen.

Deshalb interessiert uns Ihre Meinung über die guten und weniger guten Eigenschaften dieses Gerätes. Außerdem suchen wir Erfahrungen über ungewöhnliche oder neue Anwendungsmöglichkeiten. Vielleicht können Sie unseren Entwicklungs- und Konstruktionsabteilungen einen guten Wink geben; vielleicht können wir Ihre Erfahrungen aber auch in unserer Publikation Info-dienst (nur in Deutschland) veröffentlichen, damit auch andere Anwender davon profitieren können.

Deshalb möchten wir Sie bitten, die anhängende Antwortkarte auszufüllen und an uns zurückzusenden. (Entweder gleich oder -noch besser - machen Sie sich eine Notiz auf Ihrem Kalender und schicken die Karte in einem halben Jahr zurück, wenn Sie genügend praktische Erfahrungen mit dem Gerät gesammelt haben). Damit helfen Sie uns, und wir können Ihnen helfen!

Alle veröffentlichten Beiträge werden dem üblichen Tariff entsprechend honoriert. Als Dank für das Ausfüllen der Antwortkarte bieten wir Ihnen ein Freiabonnement auf Info-dienst (nur in Deutschland) oder ein kostenloses Exemplar von Teil I von unserem Kursus Digital Instrument.

L'intérêt du "feedback"

Vous voilà possesseur d'un instrument d'essai et de mesure Philips. Nous espérons qu'il vous donnera de nombreuses années de bons et loyaux services, mais nous voudrions attirer votre attention sur un point: ce n'est qu'avec **votre** aide que nous pouvons fournir des matériels d'essai et de mesure de toute première qualité.

Nous avons besoin de savoir quels en sont les points forts et les points faibles que vous avez découverts et nous serions très intéressés d'apprendre quelles applications inhabituelles ou élégantes vous lui avez trouvé. Certains de ces renseignements peuvent être transmis utilement à nos bureaux d'études; certains autres peuvent être communiqués à d'autres utilisateurs par l'intermédiaire de notre publication **T & M News** (édition française seulement en France).

C'est pourquoi nous vous serions reconnaissants de remplir la carte-réponse à côté et de nous la renvoyer (ou, mieux encore, de noter dans votre agenda que vous devez remplir la carte-réponse dans, mettons, six mois, une fois que vous aurez acquis quelque expérience pratique de l'utilisation de l'instrument). De cette façon, vous contriburez à nous fournir le "feedback" dont nous avons besoin pour mieux vous servir!

Toutes les réponses publiées seront payées conformément aux tarifs en vigueur; pour vous inciter à remplir la carte-réponse, nous offrons un abonnement gratuit à T & M News ou un exemplaire gratuit de la première partie de notre cours sur les instruments numériques à tous ceux qui répondront.

Details of user:	**Persönliche Angaben:**	**Expéditeur:**
Company	Firma	Société
Department	Abteilung	Service
Street/Box	Straße/Postfach	Rue/Boîte Postale
City/Country	Stadt/Land	Ville/Pays
Name	Name	Nom
Phone	Telefon	Numéro de téléphone

Details of instrument:	**Gerätedaten:**	**Instrument:**
Name	Name	Désignation
Type number	Typennummer	Numéro de type
Serial number	Seriennummer	Numéro de série
Date purchased	Kaufdatum	Date d'achat

What are the main applications for which you use this instrument?
Wofür verwenden Sie dieses Gerät hauptsächlich?
Quelles sont les principales utilisations auxquelles vous affectez cet instrument?

....

....

Please, list what you consider to be the **strong points** and the **weak points** of the instrument.
Zählen Sie bitte auf, was Ihrer Meinung nach die **guten Seiten** und was die **schwachen Stellen** dieses Geräts sind.
Veuillez énumérer ce que vous considérez être les **points forts** et les **points faibles** de l'instrument.

....

....

....

Do you have any queries about the use of this instrument? If so, what?
Haben Sie irgendwelche Fragen über die Anwendung dieses Geräts? Wenn ja, welche?
Avez-vous des questions à poser sur l'emploi de l'instrument? Si oui, lesquelles?

....

....

....

I have devised an interesting application for this instrument.
- ☐ I enclose a brief description (up to about 500 words) of this application
- ☐ Please, send a representative to collect information about the application
- ☐ I would like to receive **T & M News** regularly.
- ☐ Send me Digital Instrument Course Part I.

Ich habe einen interessanten Verwendungszweck für dieses Gerät gefunden.
- ☐ Eine kurze Beschreibung hiervon (max. ca. 500 Wörter) erhalten Sie anliegend.
- ☐ Senden Sie bitte jemanden, der sich an Ort und Stelle über den Verwendungszweck informieren kann.
- ☐ Ich möchte Info-dienst regelmäßig beziehen.
- ☐ Senden Sie mir Digital Instrument Course, Teil I.

J'ai trouvé une application intéressante pour cet instrument
- ☐ Je joins une brève description (500 mots environ au maximum) de cette application.
- ☐ Veuillez envoyer un représentant à qui nous donnerons des renseignements sur l'application.
- ☐ J'aimerai recevoir **T & M News** régulièrement.
- ☐ Envoyez moi la première partie du cours sur les instruments numériques.

PHILIPS

T & M News
N.V. PHILIPS' GLOEILAMPENFABRIEKEN
S & I TQ III - 2
Test and Measuring Instruments Department
Att. Mr. T. Sudar
EINDHOVEN
The Netherlands

please fold

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PHILIPS
Versatile 150 MHz oscilloscope incorporates multiplier facility
PHILIPS
digital instrument course
Part 1 BASIC BINARY THEORY AND LOGIC CIRCUITS

T & M News is your feedback unit

T & M News is a bimonthly publication issued by the Test & Measuring Department of Philips' Science & Industry Division, for distribution to actual and potential users of Philips' T & M equipment. It provides an effective means of exchanging information in the T & M field - both from the manufacturer to the customer and **vice versa.**
Apart from T & M **News itself,** we also issue **T & M News Supplement,** (only in English) which provide a vehicle for (generally longer) articles of a more specialized and/or theoretical nature to supplement the information given in **T & M News.** These supplements, being of a more specialized interest, are generally send to a more restricted group of users; though anyone who is interested can obtain them on request.
One special series that just appeared in T & M News Supplements was our Digital Instrument Course (Part I: Basic binary theory and logic circuits; Part II: Digital counters and timers; Part III: Digital voltmeters and multimeters), which proved so popular with readers that each part of the course has been re-issued in booklet form (only in English).

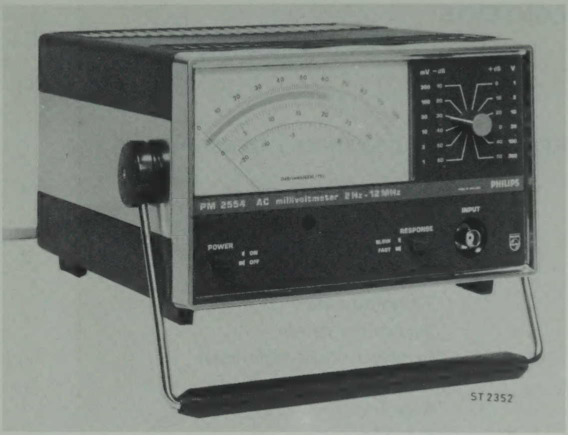
Info-dienst für Ihren Erfahrungsaustausch

Info-dienst (nur in Deutschland) ist eine Publikation der Philips GmbH Unternehmensbereich für Elektronik für Wissenschaft und Industrie für die jetzigen Besitzer und potentiellen Kunden von Philips T & M-Geräten. Dieses Blatt strebt einen effektieven Informationsaustausch auf dem T & M-Gebiet zwischen Hersteller und Anwender sowie **umgekehrt** an.
Neben diesen Info-dienst geben wir auch die **T & M News Supplements** heraus (nur in englischer Sprache), in denen (im allgemeinen längere) Artikel mehr spezieller bzw. theoretischer Art als Ergänzung zu den Informationen in Info-dienst stehen. Diese Supplements, an denen in allgemeinen nur Spezialisten interessiert sind, werden an eine begrenzte Anwendergruppe verteilt. Jeder, der daran interessiert ist, kann sie auf Anfrage erhalten.
Eine spezielle Serie, die gerade in den T & M News Supplements erschienen ist, war unser Digital Instrument Course (Teil I: Basic binary theory and logic circuits; Teil II: Digital counters and timers; Teil III: Digital voltmeters and multimeters). Diese Serie war bei den Lesern so populär, daß jeder Teil von diesem Kursus auch in Buchform herausgegeben wurde (nur in englischer Sprache).

T & M News est notre moyen de communiquer mutuellement

T & M News est une publication de département de Mesure de Philips, destinée aux utilisateurs effectifs et un puissance d'appareils d'essai et de mesure Philips. Elle constitue un moyen efficace de transmettre de l'information dans ce domaine, aussi bien du fabricant vers le client que **vice versa.**
A part la publication **T & M News proprement dite,** nous diffusons les **T & M News Supplements** (seulement en anglais) qui contiennent des articles (généralement plus longs) de nature plus spécialisée ou plus théorique, destinés à compléter l'information donnée dans **T & M News.** Etant donné leur nature, ces suppléments ne sont généralement envoyés qu'à un cercle plus restreint d'utilisateurs; toutefois, quiconque s'y intéresse peut les obtenir sur demande.
Nous venons de publier dans les T & M News Supplements une série spéciale d'articles qui constituent un cours sur les instruments numériques (1ère partie: Théorie binaire de base et circuits logiques; 2ème partie: Compteurs numériques et minuteries; 3ème partie: voltmètres et multimètres numériques) qui a rencontré un tel succès auprès des lecteurs que chaque partie du cours a été réimprimée sous forme de livret (seulement en anglais).

PHILIPS



Instruction Manual

AC-millivoltmeter
PM2554

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NOTE:

The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.

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1. INTRODUCTION

The Philips AC millivoltmeter PM 2554 is a sensitive and accurate measuring instrument suitable for floating measurements from 50 μV up to 300 V in the frequency range from 2 Hz up to 12 MHz.
The instrument can be powered by mains.
By the very great bandwidth and sensitivity the instrument has a width range of applications, e.g. measurements on LF and HF amplifiers, carrier-wave telephony, electro-acoustical as well as for measurements on transducers and measuring-transformers, etc.

The d.c. or a.c. output choosen by an internal jumper, makes it possible to employ the instrument as an a.c./d.c. converter or as an a.c. amplifier.
The instrument has a great indicating speed, a high temperature stability and is quickly ready for use.
The 12 measuring ranges of 1 mV up to 300 V f.s.d. overlap so that a high reading accuracy is obtained.
The moving-coil instrument is provided with a mirror scale with the ranges 0-30 and 0-100 as well as dB scale from −20 dB...+ 2 dB (total span −80 dB... + 52 dB).

By means of the measuring-probe PM 9336 the input impedance can be changed from 1 MΩ // 30 pF except capacity measuring cable (100 pF) into 10 MΩ // 11 pF to permit measurements on very high ohmic circuits.

2. TECHNICAL DATA

Properties expressed in numerical values with tolerances are guaranteed by the factory.
Numerical values without tolerances serve only for information and represent the properties of an average instrument.

2.1. Electrical

Measuring range	50 μV...300 V divided into 12 ranges from 1 mV...300 V (f.s.d.)
dB Measuring range	−80 dB...+ 52 dB (12 ranges) 0 dB = 1 mW into 600 Ω, 0.775 V
Frequency range	2 Hz...12 MHz
Input impedance	direct 1 MΩ // 33 pF with PM 9336: 10 MΩ // 11 pF
Accuracy	Frequency

Frequency			
10 Hz	–	400 kHz	± 1% of reading, ± 1% f.s.d.
2 Hz	–	10 Hz	± 3% of reading, ± 1% f.s.d.
400 kHz	–	2 MHz	± 2% of reading, ± 1% f.s.d.
2 MHz	–	6 MHz	± 2% of reading, ± 3% f.s.d.
6 MHz	–	12 MHz	± 4% of reading, ± 4% f.s.d.

Note: By application of probe PM 9336 the accuracy will decrease 3% of reading.

Pre-deflection	< 3 scale divisions (terminating resistance ≤ 500 Ω) Influence on accuracy: 10% pointer deflection ≤ 0.45% 30% pointer deflection ≤ 0.15%
Temperature range	0...+ 45°C
Temperature coëfficient	≤ 1^{o}/oo/°C
Effect of mains voltage variations	Additional error of 1^{o}/oo
Rectifying circuit for the meter section	Average value rectifier
Meter scale	Mirror scale with knife-edge pointer Calibrated in rms values of sinusoidal input voltages Linear division from 0...103 and 0...325 dB scale from –20 dB...+ 2 dB
Overload protection	In the ranges 1 mV to 300 mV: 300 V for frequencies between 2 Hz and 10 kHz 10 V for frequencies above 10 kHz Other ranges: 300 V for frequencies between 2 Hz and 12 MHz
Max. permissible voltage (all ranges)	Between Hi and Lo 400 Vd.c. Between Lo and housing 500 Vd.c. or 500 V_{pp}
Common mode rejection ratio (between Lo and housing)	In the 1 mV range: Frequency 10 Hz ... 1 kHz > 140 dB 1 kHz... 10 kHz > 130 dB 10 kHz...100 kHz > 120 dB *Note: These values decrease with 10 dB/range in the higher ranges.*
Impedance between Lo and housing	1 GΩ
Output	D.c. or a.c. output (choosen by internal jumper)
D.C. output	Output resistance 1 kΩ Output voltage 1 V short-circuit proof
A.C. output	Output impedance 600 Ω in serial with 47 μF Output voltage 50 mV short-circuit proof
Accuracy d.c. output	Frequency 10 Hz – 400 kHz ± 1% of reading, ± 1% f.s.d. 2 Hz – 10 Hz ± 3% of reading, ± 1% f.s.d. 400 kHz – 2 MHz ± 2% of reading, ± 1% f.s.d. 2 MHz – 6 MHz ± 2% of reading, ± 3% f.s.d. 6 MHz – 12 MHz ± 4% of reading, ± 4% f.s.d.
Supply	Mains voltage: 90 V...132 V or 180 V...265 V, 50/60 Hz.

Long-term stability	At min. 90 operating days 1^{o}/oo of f.s.d. on the average.

2.2. Mechanical

Dimensions	Height 145 mm Width 236 mm Depth 298 mm
Weight	Approx. 3.5 kg.

3. ACCESSORIES

3.1. Supplied as part of the equipment.

- Measuring cable for voltages above 3 mV and frequencies below 100 kHz
- Manual.

3.2. Optionally available.

- Measuring probe (10:1) PM 9336 (fig. 1 page 22)
- Measuring cable BNC–BNC PM 9074
  Length 1 m Impedance 50 Ω
- Measuring cable BNC–BNC PM 9075
  Length 1 m Impedance 75 Ω
- Measuring cable BNC–BNC PM 9076
  Length 1 m Impedance 135 Ω

4. PRINCIPLE OF OPERATION

Blockdiagram fig. 2 (page 22)

The test voltage connected to the "INPUT" socket is supplied to the input attenuator. This is a capacitively compensated and fully screened voltage divider with a proportion of 1:1 or 1000:1. The output of the attenuator is connected to the input of the impedance transformer consisting of a feedback two-stage amplifier.

The main attenuator following it is an ohmic voltage divider operating in steps of 10 dB and ensuring a constant and low impedance for the pre-amplifier

The latter consists of two amplifier stages with a high input impedance and a low output impedance.
The amplifier stage supplies the voltage for the a.c. output and the rectifier circuit, the rectifiers of which are included in the feedback network of an amplifier. The rectified current, which is proportional with the input voltage, flows through a test resistor.

The voltage drop across this resistor is measured differentially by means of a d.c. amplifier supplying the current for the test instrument. This amplifier also supplies the voltage for the d.c. output.

A reference voltage supplied by a calibrating-voltage generator.
With the aid of this voltage the unit can be calibrated in the 100 mV range. Furthermore this voltage renders it possible to adjust the attenuator probe; this should be done in the 10 mV range. The unit can be fed from the mains.
The equipment power supply voltage is stabilized to ensure that variations in mains supply voltage do not influence the display.

5. INSTALLATIONS

Before any other connection is made, the protective earth terminal shall be connected to a protective conductor (see section: EARTHING).

5.1. Mains supply and fuse

Before inserting the mains plug into a mains socket, make sure that the instrument is set to local mains voltage. The instrument is wired for operation from a 180 V...265 V, 50/60 Hz mains voltage.

5.1.1. Adapting of the mains voltage

Adaption of the instrument for other mains voltages is possible by altering the wiring of the mains transformer (see fig. 3 page 26)

To adapt the mains voltage proceed as follows:

- Remove the top cover by removing the two screws A (see fig. 5 page 26)
- Change the wiring of the transformer according to figure 3 page 26

The PM 2554 is suitable for mains voltages of 90 V...132 V and 180 V...265 V, 50/60 Hz.

5.2. Fuse

Make sure that only fuses with the required current rating and of the specified types are used. The use of repaired fuses and the short-circuiting of fuse holders is prohibited.

The rating of the mains fuse of the instrument should be: 50 mA d.a. for 180 V...265 V
100 mA d.a. for 90 V...132 V

5.3. Earthing

The instrument should be connected to a protective earth in accordance with the local safety regulation. This can be effected via the 3-core mains lead. The mains plug should only be inserted in a socket outlet provided with a protective contact, the protective action of which is not cancelled by the use of an extension card or device without protective conductor.

5.4. Rackmounting

The PM 2554 can be mounted in a 19" rack by using a mounting-set as shown in fig. 22 page 27. This set is not delivered by Philips.

6. OPERATION

6.1. Mechanical zerosetting

- Place the meter in a horzontal position and check the zero-setting of the meter.
- If necessary correct the setting by means of plastic screw "A", fig. 4 (page 26)

6.2. Switching on

The instrument is ready for use after connection to the mains and earthing.
It is switched on by means of switch POWER ON (S 2).
A warming-up time of approximately 30 min. should be observed to obtain full accuracy.

6.3. Calibration

6.3.1. Instrument

- Select measuring range 100 mV
- Put the signal lead (Hi) to the connector X4 at the rear
- Adjust the meter to 100 scale divisions with potentiometer "CAL" (R 80).

6.3.2. Measuring probe PM 9336

- Before adjusting, the instrument should be calibrated as described above
- Select measuring range 10 mV
- Put the signal lead (Hi) to the connector X4 at the rear
- Adjust the probe by means of adjusting screw "A", fig. 1 (page 22).

6.4. Measuring

- Select the correct measuring range with range selector S 101
- Connect the test voltage to coaxial socket "INPUT" (X1) with the delivered measuring cable.

Notes:

- *By means of the 10:1 measuring probe PM 9336 the input impedance can be increased from 1 MΩ//30 pF (except capacity of the cable: 100 pF) to 10 MΩ//11 pF.*
  This permits of carrying out measurements on very high-ohmic circuits.
- *Do not use the delivered measuring cable for measuring voltages below 3 mV, and/or with a frequency above 100 kHz.*
- *In case of measurements of voltages in the lowest range, (1 mV) or with high frequencies (above 1 MHz) it may occur that h.f. interference signals respectively the standing wave ratio will influence the results. Therefore it is advised to shield the measurements circuit.*
- *For measurements at low frequencies, switch SLOW-FAST (S 102) should be set in position SLOW to obtain a proper reading.*
  As a result the indicating speed of the meter will be reduced and the pointer deflection will become more stable.

6.5. Output (X2 and X3)

The instrument is provided with a floating output.
The Lo is directly connected to the shield of the "INPUT" connector X1.
By means of an internal jumper or a d.c. output or an a.c. output is selected.
(see fig. 16 page 42).

6.5.1. D.C. output

The output voltage is proportional to the input voltage and is 1 V at full scale deflection, irrespective of the selected measuring range.
The output resistance is approx. 1 kΩ.

6.5.2. A.C. output

The output voltage is proportional to the input voltage and is 50 mV at full scale deflection, irrespective of the selected measuring range.
The output impedance is approx. 600 Ω in serial with 47 μF.

6.6. Errors due to disortion.

Although the meter indicates the mean value of the full-wave rectified voltage, the scale of the instrument is calibrated in rms values of sinewave voltages. As a result measuring errors will arise when measuring non-sinusoidal voltage.

The values of these depend on the coëfficient of non-lineair distortion.

1. EINLEITUNG

ALLGEMEINES

Das Philips Wechselspannungs-Millivoltmeter PM 2554 ist ein empfindliches und genaues Messgerät für erdfreie Messungen von 50 µV bis 300 V im Frequenzbereich von 2 Hz bis 12 MHz.
Das Gerät ist für Netzbetrieb geeignet. Wegen der sehr grossen Bandbreite und der sehr hohen Empfindlichkeit kann das Gerät für die verschiedenartigsten Messungen verwendet werden. z.b. an NF- und HF-Verstärkern, für die Trägerfrequenztelefonie, für die Elektroakustik und für Messungen an Messwertwandlern und Messtransformatoren usw.

Der mit Hilfe einer internen Verbindungsbrücke einstellbare Gleichspannungs- oder Wechselspannungsausgang ermöglicht Verwendung des Gerätes als Wechselstrom/Gleichstrom Umwandler oder als Wechselstromverstärker. Ferner zeichnet das Gerät sich durch seine grosse Anzeigegeschwindigkeit, die hohe Temperaturstabilität und die schnelle Betriebsbereitschaft aus.
Die 12 Messbereiche von 1 mV bis 300 V Skalenendwert überlappen sich so, dass eine gute Ablesegenauigkeit gewährleistet ist. Das Drehspulinstrument besitzt eine Spiegelskala mit Einteilungen von 0 bis 30 und 0 bis 100 sowie eine dB-Skala von –20 dB...+ 2 dB (gesamter Bereichsumfang –80 dB...+ 52 dB).

Mit dem Messkopf PM 9336 lässt die Eingangsimpedanz sich von 1 MΩ//30 pF (Kabelkapazität zusätzlich 100 pF) für Messungen an hochohmigen Schaltungen auf 10 MΩ//11 pF erhöhen.

2. TECHNISCHE DATEN

Zahlwerte mit Toleranzangabe werden vom Hersteller garantiert.
Zahlwerte ohne Toleranzangabe sind nur zur Information und geben die Eigenschaften eines durchschnittlichen Gerätes an.

2.1. Elektrische daten

Messbereich	50 µV...300 V, in 12 Teilbereich von 1 mV...300 V (Skalenendwert)
dB-Bereich	–80 dB...+ 52 dB (12 Teilbereiche) 0 dB = 1 mW an 600 Ω, entsprechend 0,775 V
Frequenzbereich	2 Hz...12 MHz
Eingangsimpedanz	direkt 1 MΩ//33 pF mit PM 9336: 10 MΩ//11 pF
Fehlergrenze	Frequenz: 10 Hz – 400 kHz ± 1% vom angezeigten Wert ± 1% vom Skalenendwert 2 Hz – 10 Hz ± 3% vom angezeigten Wert ± 1% vom Skalenendwert 400 kHz – 2 MHz ± 2% vom angezeigten Wert ± 1% vom Skalenendwert 2 MHz – 6 MHz ± 2% vom angezeigten Wert ± 3% vom Skalenendwert

	6 MHz — 12 MHz ± 4% vom angezeigten Wert ± 4% vom Skalenendwert. *Anmerkung: Bei Verwendung des Messkopfes PM 9336 wird die genauigkeit um 3% des angezeigten Wertes verringert*
Grundausschlag	< 3 Skalenteile (Abschlusswiderstand ≤ 500 Ω) Einfluss auf die Genauigkeit: 10% Zeigerausschlag ≤ 0,45% 30% Zeigerausschlag ≤ 0,15%
Temperaturbereich	0...+ 45°C
Temperaturkoeffizient	≤ 1°/oo/°C
Einfluss von Netzspannungsänderungen	Zusätzlichen Messfehler: 1°/oo
Gleichrichterschaltung im Messkreis	Mittelwertgleichrichter
Instrumentenskala	Spiegelskala mit Messerzeiger Geeignet in Effektivwerten einer Sinusspannung Lineare Teilung von 0...103 und 0...325 dB-Skala von −20 dB...+ 2 dB
Überlastungsschutz	In den Bereichen 1 mV bis 300 mV: 300 V bei Frequenzen von 2 Hz bis 10 kHz 10 V bei Frequenzen über 10 kHz Übrige Bereiche: 300 V bei Frequenzen von 2 Hz bis 12 MHz.
Max. zulässige Spannung (in allen Bereichen)	Zwischen Hi und Lo 400 V Gleichspannung Zwischen Lo und Gehäuse 500 V Gleichspannung oder 500 V_{ss}
Gleichtaktunterdrückung (zwischen Lo und Gehäuse)	Im 1 mV Bereich Frequenz: 10 Hz ... 1 kHz > 140 dB 1 kHz ... 10 kHz > 130 dB 10 kHz ...100 kHz > 120 dB *Anmerkung: In den höheren Bereichen sinken diese Werte um 10 dB pro Bereich.*
Impedanz zwischen Lo und Gehäuse	1 GΩ
Ausgang	Gleichspannungs- oder Wechselspannungsausgang (eingestellt mit interner Verbindungsbrücke)
Gleichspannungsausgang	Ausgangswiderstand 1 kΩ Ausgangsspannung 1 V kurzschlussfest
Wechselspannungsausgang	Ausgangsimpedanz 600 Ω in Reihe mit 47 µF Ausgangsspannung 50 mV, kurzschlussfest

Fehlergrenze des Gleichspannungsausgangs	Frequenz	
	10 Hz – 400 kHz	± 1% vom abgelesenen Wert ± 1% vom Skalenendwert
	2 Hz – 10 Hz	± 3% vom abgelesenen Wert ± 1% vom Skalenendwert
	400 kHz – 2 MHz	± 2% vom abgelesenen Wert ± 1% vom Skalenendwert
	2 MHz – 6 MHz	± 2% vom abgelesenen Wert ± 3% vom Skalenendwert
	6 MHz – 12 MHz	± 4% vom abgelesenen Wert ± 4% vom Skalenendwert
Stromversorgung	Netzspannung: 90 V...132 V oder 180 V...265 V, 50/60 Hz	
Langzeitstabilität	An minimal 90 Betriebstagen 1^{o}/oo vom Skalenendwert, bezogen auf den Mittelwert.	

2.2. Mechanische daten

Abmessungen	Höhe	145 mm
	Breite	236 mm
	Tiefe	298 mm
Gewicht	ca. 3,5 kg.	

3. ZUBEHÖR

3.1. Mit dem Gerät mitgeliefertes zubehör

- Messkabel für Spannungen über 3 mV und Frequenzen unter 100 kHz
- Betriebsanleitung

3.2. Wahlzubehör

- Messkopf (10:1) PM 9336 (Abb. 1, Seite 22)
- Messkabel BNC–BNC PM 9074
  Länge 1 m, Impedanz 50 Ohm
- Messkabel BNC–BNC PM 9075
  Länge 1 m, Impedanz 75 Ohm
- Messkabel BNC–BNC PM 9076
  Länge 1 m, Impedanz 135 Ohm

4. WIRKUNGSWEISE

Blockschaltbild Abb. 2 (Seite 22)

Die an Buchse "INPUT" liegende zu messende Spannung wird dem Eingangsabschwächer zugeführt. Dies ist ein kapazitiv kompensierter und voll abgeschirmter Spannungsteiler mit einem Teilungsverhältnis von 1:1 oder 1000:1. Anschliessend kommt die zu messende Spannung an den Impedanzwandler, bestehend aus einem zweistufigen, gegengekoppelten Verstärker.

Der nun folgende Hauptabschwächer ist ein ohmscher Spannungsteiler in Stufen von 10 dB, der an den Vorverstärker ein konstantes und niederohmiges Signal liefert.

Der Vorverstärker besteht aus zwei Verstärkerstufen mit hoher Eingangsimpedanz und niedriger Ausgangsimpedanz. Die Verstärkerstufe liefert die Spannung für den Wechselspannungsausgang und die Gleichrichterschaltung, deren Gleichrichter ein Teil des Rückkopplunggliedes eines Verstärkers sind.
Der der Eingangsspannung proportionale gleichgerichtete Strom fliesst durch einen Messwiderstand.

Der Strom durch diesen Widerstand wird mit einem Differentialverstärker gemessen, der den Strom für das Messinstrument liefert. Ausserdem liefert dieser Verstärker die Spannung für den Gleichspannungsausgang.

Bei Netzbetrieb erzeugt der eingebaute Eichspannungsgenerator eine Vergleichsspannung.
Hiermit kann das Gerät im 100 mV Bereiche kalibriert werden. Ausserdem lässt sich mit dieser Spannung der Spannungsteilermesskopf abgleichen; dies muss im 10 mV Bereich erfolgen. Das Gerät wird vom Netz gespeist.

Die Speisespannung ist stabilisiert um zu verhindern dass Netzspannungsschwankungen die Anzeige beeinflussen.

5. INSTALLATION

Vor Anschluss des Geräts an eine Stromquelle muss der Erdschutzklemme mit einem Schutzleiter verbunden werden (siehe Abschnitt "ERDUNG").

5.1. Netzspannung und Sicherung

Vor Einführen des Netzsteckers in eine Netzbuchse überzeuge man sich, dass das Gerät für die örtliche Netzspannung eingestellt ist.
Das Gerät ist für Betrieb von einem 180 V...265 V, 50/60 Hz Netz verdrahtet.

5.1.1. Anpassung der Netzspannung

Das Gerät lässt sich durch Änderung der Anschlüsse des Netztransformators für andere Netzspannungen anpassen (siehe Abb. 3, Seite 26).

Anpassung der Netzspannung wird wie folgt vorgenommen:

- die beiden Schrauben A lösen und Deckel abnehmen (siehe Abb. 5, Seite 26)
- die Verdrahtung des Transformators anhand Abb. 3, Seite 26 ändern.

Das PM 2554 ist für Netzspannungen von 90 V...132 V und 180 V..265 V, 50/60 Hz geeignet.

5.2. Sicherung

Es dürfen nur Sicherungen des vorgeschriebenen Type und Stromwertes verwendet werden.
Reparierte Sicherungen und Kurzschliessen des Sicherungshalters ist verboten.
Die Sicherung des Gerätes, muss sein: 50 mA, träge für 180 V...265 V
100 mA, träge für 90 V...132 V

5.3. Erdung

Das Gerät ist den örtlichen Sicherheitsvorschriften entsprechend zu erden.
Dies kann mit dem 3-adrigen Netzkabel erfolgen. Der Netzstecker muss in eine Schukostechdose gesteckt werden. Diese Schutzmassnahme darf nicht unwirksam gemacht werden, z.B. durch eine unvollkommene Verlängerungsleitung!

5.4. Gestelleinbau

Das PM 2554 kann mit Hilfe eines Bausatzes (siehe Abb. 22, Seite 27) in ein 19" Gestell eingebaut werden.
Dieser Satz wird nicht durch Philips geliefert.

6. BEDIENUNG

6.1. Mechanische Nullpunkteinstellung

- Das Gerät waagerecht hinstellen und die Nullpunkteinstellung des Instruments kontrollieren.
- Falls erforderlich, mit der Plastikschraube "A", Abb. 4 (Seite 26) korrigieren.

6.2. Einschalten

Nach dem Netzanschluss und der Erdung ist das Gerät betriebsbereit.
Es wird mit dem Schalter "POWER ON" (S 2) eingeschaltet.
Die volle Genauigkeit wird nach einer Anwärmzeit von ca. 30 Min. erreicht.

6.3. Kalibrierung

6.3.1. Instrument

- Messbereich 100 mV einschalten
- Die Signalader (Hi) an den Stecker X4 an der Rückseite anschliessen
- Mit Potentiometer "CAL" (R 80) den Zeiger auf 100 Skalenteile stellen.

6.3.2. Messkopf PM 9336

- Vor dem Abgleich des Messkopfes muss das Gerät wie oben beschrieben kalibriert werden
- Messbereich 10 mV einschalten
- Die Signalader (Hi) an den Stecker X4 an der Rückseite anschliessen
- Mit Abgleichschraube "A" Abb. 1 (Seite 22) den Messkopf abgleichen

6.4. Messen

- Mit dem Bereichsschalter S 101 den richtigen Messbereich einschalten
- Mit Hilfe des mitgelieferten Messkabels die zu messende Spannung an die Koaxialbuchse "INPUT" (X 1) anschliessen.

Anmerkungen:

- *Mit dem Spannungsteiler Messkopf 10:1 PM 9336 kann die Eingangsimpedanz von 1 MOhm//30 pF (zusätzliche Kabelkapazität: 100 pF) auf 10 MOhm//11 pF erhöht werden. Damit sind Messungen an sehr hochohmigen Schaltungen möglich.*
- *Das mitgelieferte Messkabel nicht für Messspannungen under 3 mV und/oder mit einer Frequenz über 100 kHz verwenden.*
- *Bei Messungen von Spannungen im niedrigsten Bereich (1 mV) oder mit hohen Frequenzen (über 1 MHz) ist zu beachten, dass HF-Störsignale bzw. das Stehwellenverhältnis das Messergebnis beeinflussen können. Deshalb wird empfohlen, die Messschaltung abzuschirmen.*
- *Bei niedrigeren Frequenzen muss der Schalter "SLOW-FAST" (S 102) in Position "SLOW" geschaltet werden, um eine einwandfreie Ablesung zu erhalten. Dadurch wird die Anzeigezeit des Messinstrumentes verzögert und der Zeigerausschlag stabiler.*

6.5. Output (X2 und X3)

Der Ausgang des Gerätes ist erfrei.
Lo ist direkt mit der Abschirmung der Buchse "INPUT" (X1) verbunden.
Mit Hilfe einer internen Verbindungsbrücke lässt sich ein Gleich- oder Wechselspannungsausgang einstellen (siehe Abb. 16, Seite 42).

6.5.1. Gleichspannungsausgang

Die Ausgangsspannung ist proportional der Eingansspannung und beträt bei Vollausschlag 1 V, ungeachtet des gewählten Messbereichs.
Der Ausgangswiderstand beträgt etwa 1 kΩ.

6.5.2. Wechselspannungsausgang

Die Ausgangsspannung ist proportional der Eingangsspannung und beträgt bei Vollausschlag 50 mV, ungeachtet des gewählten Messbereichs.
Die Ausgangsimpedanz ist etwa 600 Ω in Reihe mit 47 μF.

6.6. Fehler durch Verzerrung

Von dem Messinstrument wird der Mittelwert einer in Doppelwegschaltung gleichgerichteten Wechselspannung angezeigt. Die Spannung ist jedoch in Effektivwerten einer Sinusspannung kalibriert.
Dadurch entstehen Messfehler wenn nicht Sinusförmige Spannungen gemessen werden.
Die Höhe dieses Messfehlers hängt von den nichtlinearen Verzerrungen der zu messenden Spannung ab.

1. INTRODUCTION

GENERALITES

Le millivoltmètre alternatif Philips PM 2554 est un appareil de mesure sensible et précis adéquat à des mesures flottantes de 50 μV à 300 V dans la gamme de fréquence de 2 Hz à 12 MHz.
L'appareil doit être alimenté par secteur. Etant donnè sa grande largeur de bande et sa sensibilité, l'appareil trouve son application dans de nombreux domaines, par exemple les mesures sur des amplificateurs BF et HF, en téléphonie sans fil, en électro-acoustique ainsi que les mesures sur des capteurs, des transformateurs de mesure etc.

La sortie continue ou alternative choise par un cavalier interne permet d'utiliser l'appareil en tant que convertisseur alternatif-continu ou amplificateur alternatif.
Cet appareil a une vitesse d'affichage rapide, une stabilité à haute température et il est très rapidement prêt à l'usage.
Les 12 gammes de mesure de 1 mV à 300 V pleine déviation d'échelle se chevauchent, de sorte qu'une haute précision d'affichage est obtenue. L'appareil à cadre mobile est pourvu d'une échelle à miroir à gammes 0—30 et 0—100 ainsi que d'une échelle dB, de —20 dB...+ 2 dB (gamme totale —80 dB...+ 52 dB).

Avec la sonde de mesure PM 9336, l'impédance d'entrée peut être modifiée de 1 MΩ//30 pF en 10 MΩ//11 pF, exception faite du câble de mesure de capacité (100 pF), afin de permettre les mesures sur des circuits à très haute impédance.

2. CARACTÉRISTIQUES TECHNIQUES

Les propriétés exprimées en valeurs numériques avec tolérances sont garanties par l'usine.
Les valeurs numériques sans indication de tolérances servent unitquement d'information et constituent les propriétés d'un appareil moyen.

2.1. Caractéristiques electriques

Gammes de mesure	50 μV...300 V divisée en 12 gamme de 1 mV à 300 V (pleine déviation d'échelle)
Gamme de mesure dB	—80 dB...+ 52 dB (12 gammes) 0 dB = 1 mW en 600 Ω, 0,775 V
Gamme de fréquence	2 Hz...12 MHz
Impédance d'entrée	directe 1 MΩ//33 pF avec PM 9336: 10 MΩ//11 pF
Précision	Fréquence:

10 Hz	—	400 kHz	± 1% d'affichage, ± 1% pleine échelle
2 Hz	—	10 Hz	± 3% d'affichage, ± 1% pleine échelle
400 kHz	—	2 MHz	± 2% d'affichage, ± 1% pleine échelle
2 MHz	—	6 MHz	± 2% d'affichage, ± 3% pleine échelle
6 MHz	—	12 MHz	± 4% d'affichage, ± 4% pleine échelle

Remarque: En cas d'application de la sonde PM9336, la précision est diminuée de 3% de l'affichage.

Pré-déflexion	< 3 divisions d'échelle (terminaison ≤ 500 Ω) Influence de la précision: 10% de déflexion d'index ≤ 0,45% 30% de déflexion d'index ≤ 0,15%
Gamme de température	0...+ 45°C
Coefficient de température	≤ 1°/oo/°C
Effet des variations de tension secteur	Erreur de mesure supplémentaire de 1°/oo
Circuit redresseur pour la section mètre	Redresseur moyen
Échelle de mètre	Échelle à miroir avec aiguille en couteau Etalonnée en valeurs nominales des tensions d'entrée sinusoïdales Divisions linéaire de 0 à 103 et 0 à 325 Échelle dB de −20 dB...+ 2 dB
Protection de surcharge	Dans les gammes 1 mV à 300 mV 300 V pour des fréquences entre 2 Hz et 10 kHz 10 V pour des fréquences supérieures à 10 kHz Autres gammes: 300 V pour des fréquences entre 2 Hz et 12 MHz
Tension maximale admise (toutes gammes)	Entre Hi et Lo 400 V continu Entre Lo et boîtier 500 V continu ou 500 V_{cc}
Rapport de réjection de mode commun (entre Lo et boitîer)	Dans la gamme 1 mV Fréquence: 10 Hz ... 1 kHz > 140 dB 1 kHz... 10 kHz > 130 dB 10 kHz...100 kHz > 120 dB *Remarque: Ces valeurs diminuent de 10 dB par gamme dans les gammes supérieures.*
Impédance entre Lo et Boîtier	1 GΩ
Sortie	Continue ou alternative (par cavalier interne)
Sortie continue	Résistance de sortie 1 kΩ Tension de sortie 1 V exempt de courts-circuits
Sortie alternative	Impédance de sortie 600 Ω en série avec 47 µF Tension de sortie 50 mV exempt de courts-circuits.
Précision de sortie continue	Fréquence: 10 Hz — 400 kHz ± 1% d'affichage, ± 1% pleine échelle 2 Hz — 10 Hz ± 3% d'affichage, ± 1% pleine échelle 400 kHz — 2 MHz ± 2% d'affichage, ± 1% pleine échelle 2 MHz — 6 MHz ± 2% d'affichage, ± 3% pleine échelle 6 MHz — 12 MHz ± 4% d'affichage, ± 4% pleine échelle
Alimentation	Tension secteur: 90 V...132 V ou 180 V...265 V, 50/60 Hz
Stabilité à long terme	Pour un minimum de 90 jours de fonctionnement 1°/oo pleine déviation d'échelle en moyenne.

2.2. Caractéristiques mecaniques

Dimensions	Hauteur : 145mm Largeur : 236mm Profondeur : 298mm
Poids	environ 3,5kg

3. ACCESSOIRES

3.1. Compris a la livraison de l'appareil

- Câble de mesure pour tensions supérieures à 3 mV et fréquences inférieures à 100 kHz
- Notice d'emploi et d'entretien

3.2. En option

- Sonde de mesure (10:1) PM 9336 (fig. 1 page 22)
- Câble de mesure BNC–BNC PM 9074
  Longeur 1m Impédance 50 Ω
- Câble de mesure BNC–BNC PM 9075
  Longeur 1m Impédance 75 Ω
- Câble de mesure BNC–BNC PM 9076
  Longeur 1m Impédance 135 Ω

2.2. Caractéristiques mecaniques

Dimensions	Hauteur : 145mm Largeur : 236mm Profondeur : 298mm
Poids	environ 3,5kg

3. ACCESSOIRES

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- Câble de mesure BNC–BNC PM 9075
  Longeur 1m Impédance 75 Ω
- Câble de mesure BNC–BNC PM 9076
  Longeur 1m Impédance 135 Ω

4. PRINCIPE DE FONCTIONNEMENT

Schéma synoptique fig. 2 (page 22)

La tension de test connectée à la douille "INPUT" est appliquée à l'atténuateur d'entrée.
Il s'agit d'un diviseur de tension de proportion 1:1 ou 1000:1 compensé en capacité et complètement blindé.
La sortie de l'atténuateur est connectée à l'entrée du transformateur d'impédance formé d'un amplificateur à deux étages à contre-réaction.

L'atténuateur principal le suivant est un diviseur de tenstion ohmique fonctionnant par échelons de 10 dB et assurant une impédance constante et basse pour le pré-amplificateur.

La dernière comporte deux étages amplificateur à forte impédance d'entrée et faible impédance de sortie.
L'étage amplificateur fournit la tension à la sortie alternative et au circuit redresseur, dont les redresseurs sont compris dans un réseau de contre-réaction d'un amplificateur. Le courant redressé, lequel est proportionnel à la tension d'entrée, passe travers une résistance de mesure.

La chute de tension par cette résistance est mesurée différemment à l'aide d'un amplificateur continu qui produit le courant nécessaire à l'appareil à tester. Cet amplificateur produit également la tension pour la sortie continue.

Une tension référence est fournie par un générateur de tension d'étalonnage. Avec cette tension l'unité peut être étallonnée dans la gamme 100 mV. De plus, cette tension permet de régler la sonde atténuatrice; ceci doit se faire dans la gamme 10 mV. L'unité peut être alimentée par secteur.

La tension d'alimentation est stabilisée de sorte que des fluctuations de la tension secteur ne puissent pas influencés l'affichage.

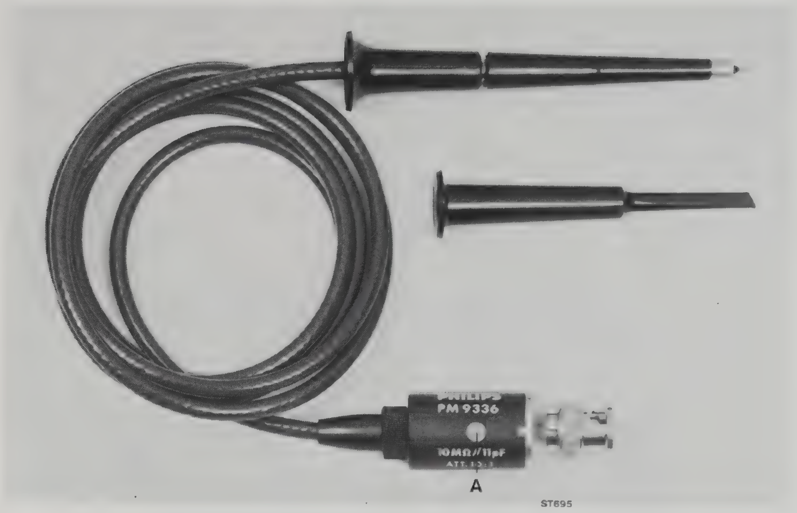

Fig. 1.

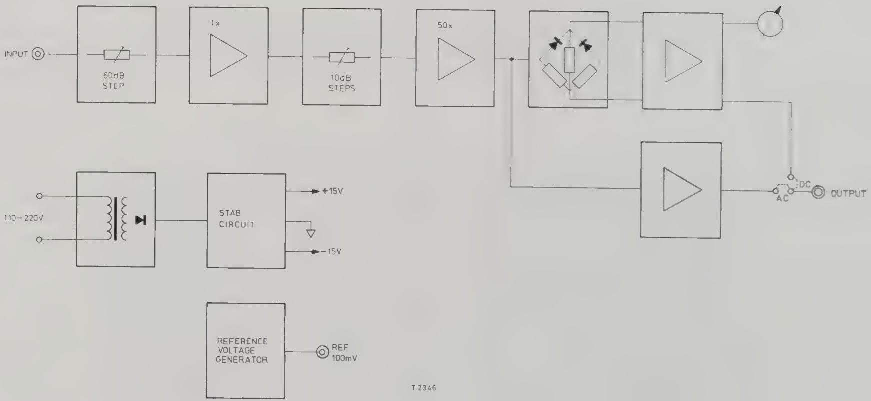

Fig. 2.

5. INSTALLATION

Avant de réaliser une connexion, la protection de terre doit être reliée à une conducteur de protection. (voir mise à la terre).

5.1. Alimentation secteur et fusible

Avant de brancher l'appareil au secteur, s'assurer que l'appareil est réglé sur la tension secteur locale. L'appareil sort de l'usine pour fonctionnement sur secteur 180 V...265 V, 50/60 Hz.

5.1.1. Adaptation à la tension secteur

L'appareil peut être adapté à d'autres tensions secteur par modification du câblage de transformateur secteur (fig. 3, page 26).
Pour adapter l'appareil à la tension secteur, procéder comme suit:

- Déposer le couvercle supérieur après avoir déposé les 2 vis A (fig. 5, page 26)
- Modifier le câblage du transformateur conformément à la figure 3, page 26

Le PM 2554 peut être alimenté par secteurs 90 V...132 V et 180 V...265 V, 50/60 Hz.

5.2. Fusible

S'assurer que les fusibles utilisés sont adéquats. L'utilisation de fusibles réparés et la court-circuitage des porte-fusibles sont interdits.
Le fusible secteur doit être:50 mA à action différée pour 180 V...265 V
100 mA à action différée pour 90 V...132 V

5.3. Mise à la terre

L'appareil doit être connecté à la terre de protection conformément aux régles de sécurité locales. Ceci se fait à l'aide du fil à trois conducteurs. La fiche secteur ne peut être enfichée que dans une prise à contact, dont l'action n'est pas supprimée en cas d'utilisation d'une platine ou d'une unité de prolongement sans conducteur protecteur.

5.4. Montage en rack

Le PM 2554 peut être monté dans un rack 19" à l'aide d'un set de montage (voir fig. 22, page 27). Ce set n'est pas livré par Philips.

6. OPÉRATION

6.1. Reglage mecanique du zero

- Mettre l'appareil en position horizontale et contrôler le réglage du zéro du mètre.
- Au besoin, corriger le réglage à l'aide de la vis en plastique "A" (fig. 4, page 26).

6.2. Enclenchement

L'appareil est prêt à l'usage après connexion au secteur et mise à la terre.
L'enclenchement se fait à l'aide du commutateur POWER ON (S 2).
Il est nécessaire d'observer un temps de chauffage d'environ 30 minutes afin d'obtenir une précision totale.

6.3. Etalonnage

6.3.1. Appareil

- Sélectionner la gamme de mesure 100 mV
- Appliquer le signal (Hi) au connecteur X4 à l'arrière
- Régler l'appareil sur 100 divisions d'échelle avec le potentiomètre "CAL" (R 80)

6.3.2. Sonde de mesure PM 9336

- Avant le réglage, l'appareil doit être étalonné comme décrit ci-avant
- Sélectionner la gamme de mesure 10 mV
- Appliquer le signal (Hi) au connecteur X4 à l'arrière
- Régler la sonde à l'aide de la vis de réglage "A" (fig. 1, page 22)

6.4. Mesure

- Sélectionner la gamme de mesure exacte avec le sélecteur S 101
- Connecter la tension de test à la douille coaxiale "INPUT" (X1) avec la câble de mesure compris à la livraison.

Remarques:

- *L'impédance d'entrée peut être augmentée de 1 MΩ//30 pF (à l'exception de la capacité de câble:100 pF) à 10 MΩ//11 pF à l'aide de la sonde de mesure 10:1 PM 9336.*
- *Ne pas utiliser le câble de mesure livré pour tensions de mesure inférieures 3 mV et/ou avec fréquence supérieure à 100 kHz.*
- *En cas de mesures de tensions dans la gamme inférieure (1 mV) ou à hautes fréquences (supérieures à 1 MHz) des signaux d'interférence ou la rapport d'amplitude peuvent influencer respectivement les résultats. C'est pourquoi le circuit de mesure doit être blindé.*
- *Pour les fréquences plus basses, placer le commutateur "SLOW-FAST" (S 102) en position "SLOW"; le temps d'indication de l'instrument de mesure est augmenté et la déviation d'aiquille devient plus stable.*

5. INSTALLATION

Avant de réaliser une connexion, la protection de terre doit être reliée à une conducteur de protection.
(voir mise à la terre).

5.1. Alimentation secteur et fusible

Avant de brancher l'appareil au secteur, s'assurer que l'appareil est réglé sur la tension secteur locale.
L'appareil sort de l'usine pour fonctionnement sur secteur 180 V...265 V, 50/60 Hz.

5.1.1. Adaptation à la tension secteur

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Pour adapter l'appareil à la tension secteur, procéder comme suit:

- Déposer le couvercle supérieur après avoir déposé les 2 vis A (fig. 5, page 26)
- Modifier le câblage du transformateur conformément à la figure 3, page 26

Le PM 2554 peut être alimenté par secteurs 90 V...132 V et 180 V...265 V, 50/60 Hz.

5.2. Fusible

S'assurer que les fusibles utilisés sont adéquats. L'utilisation de fusibles réparés et la court-circuitage des porte-fusibles sont interdits.
Le fusible secteur doit être:50 mA à action différée pour 180 V...265 V
100 mA à action différée pour 90 V...132 V

5.3. Mise à la terre

L'appareil doit être connecté à la terre de protection conformément aux régles de sécurité locales. Ceci se fait à l'aide du fil à trois conducteurs. La fiche secteur ne peut être enfichée que dans une prise à contact, dont l'action n'est pas supprimée en cas d'utilisation d'une platine ou d'une unité de prolongement sans conducteur protecteur.

5.4. Montage en rack

Le PM 2554 peut être monté dans un rack 19" à l'aide d'un set de montage (voir fig. 22, page 27). Ce set n'est pas livré par Philips.

6. OPÉRATION

6.1. Reglage mecanique du zero

- Mettre l'appareil en position horizontale et contrôler le réglage du zéro du mètre.
- Au besoin, corriger le réglage à l'aide de la vis en plastique "A" (fig. 4, page 26).

6.2. Enclenchement

L'appareil est prêt à l'usage après connexion au secteur et mise à la terre.
L'enclenchement se fait à l'aide du commutateur POWER ON (S 2).
Il est nécessaire d'observer un temps de chauffage d'environ 30 minutes afin d'obtenir une précision totale.

6.3. Etalonnage

6.3.1. Appareil

- Sélectionner la gamme de mesure 100 mV
- Appliquer le signal (Hi) au connecteur X4 à l'arrière
- Régler l'appareil sur 100 divisions d'échelle avec le potentiomètre "CAL" (R 80)

6.3.2. Sonde de mesure PM 9336

- Avant le réglage, l'appareil doit être étalonné comme décrit ci-avant
- Sélectionner la gamme de mesure 10 mV
- Appliquer le signal (Hi) au connecteur X4 à l'arrière
- Régler la sonde à l'aide de la vis de réglage "A" (fig. 1, page 22)

6.4. Mesure

- Sélectionner la gamme de mesure exacte avec le sélecteur S 101
- Connecter la tension de test à la douille coaxiale "INPUT" (X1) avec la câble de mesure compris à la livraison.

Remarques:

- *L'impédance d'entrée peut être augmentée de 1 MΩ//30 pF (à l'exception de la capacité de câble:100 pF) à 10 MΩ//11 pF à l'aide de la sonde de mesure 10:1 PM 9336.*
- *Ne pas utiliser le câble de mesure livré pour tensions de mesure inférieures 3 mV et/ou avec fréquence supérieure à 100 kHz.*
- *En cas de mesures de tensions dans la gamme inférieure (1 mV) ou à hautes fréquences (supérieures à 1 MHz) des signaux d'interférence ou la rapport d'amplitude peuvent influencer respectivement les résultats. C'est pourquoi le circuit de mesure doit être blindé.*
- *Pour les fréquences plus basses, placer le commutateur "SLOW-FAST" (S 102) en position "SLOW"; le temps d'indication de l'instrument de mesure est augmenté et la déviation d'aiquille devient plus stable.*

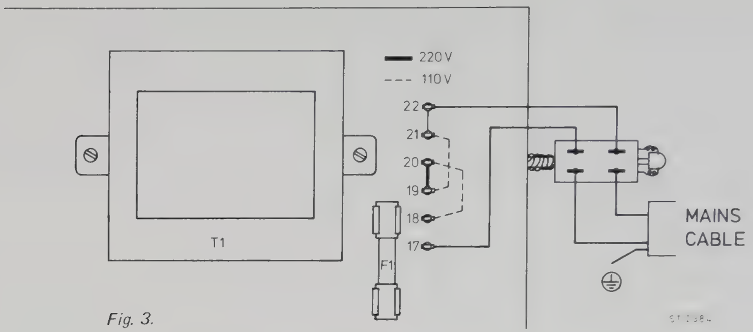

Fig. 3.

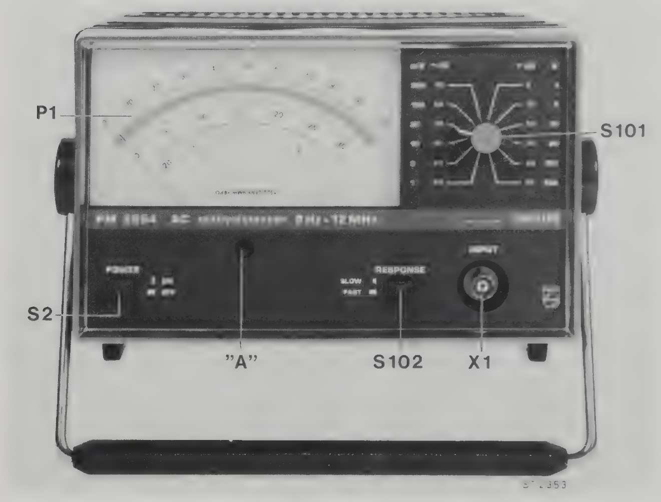

Fig. 4.

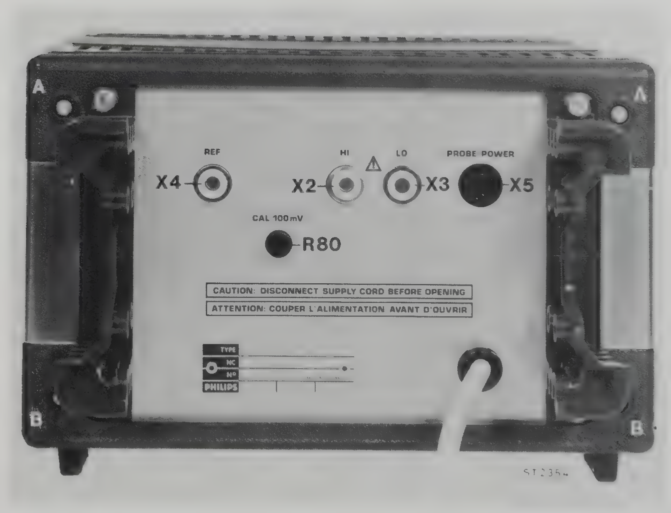
A
A
REF
HI
LO
PROBE POWER
X4
X2
X3
X5
CAL 100 mV
R80
CAUTION: DISCONNECT SUPPLY CORD BEFORE OPENING
ATTENTION: COUPER L'ALIMENTATION AVANT D'OUVRIR
PHILIPS
B
B

Fig. 5.

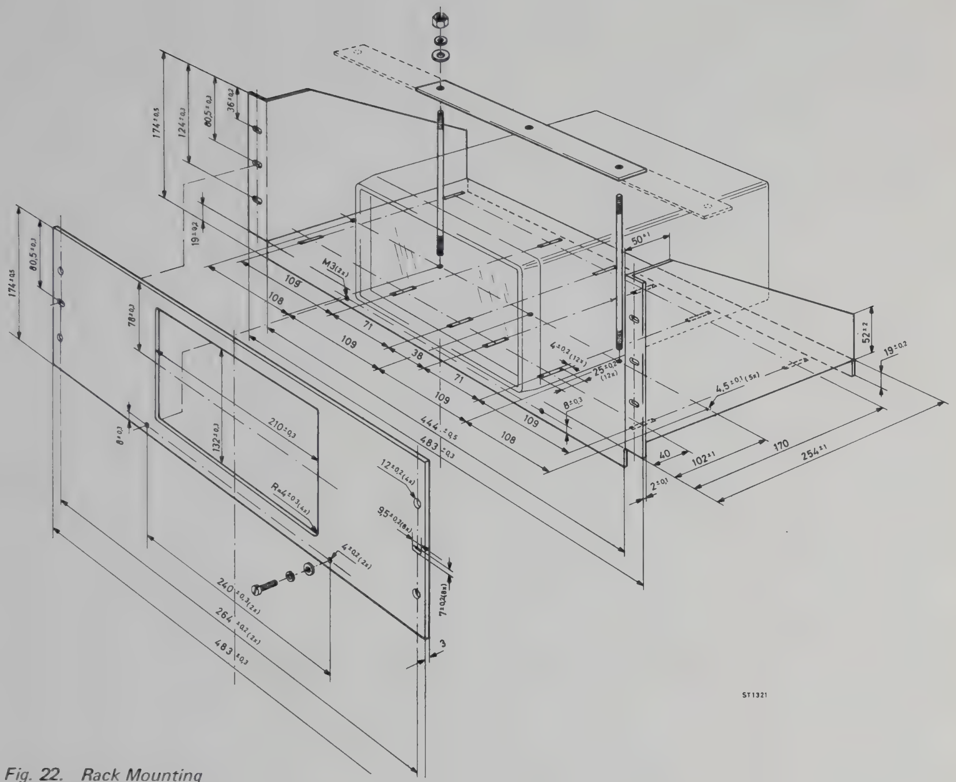

Fig. 22. Rack Mounting

6.5. Sortie (X2 et X3)

L'appareil est pourvu d'une sortie flottante.
Lo est directement connecté au blindage du connecteur "INPUT" X1.
Un cavalier interne permet de choisir soit une sortie continue soit une sortie alternative (voir fig. 16, page 42)

6.5.1. Sortie continue

La tension de sortie est proportionnelle à la tension d'entrée et est de 1 V pour pleine déviation d'échelle quelle que soit la gamme de mesure choisie.
La résistance de sortie est d'environ 1 kΩ.

6.5.2. Sortie alternative

La tension de sortie est proportionnelle à la tension d'entrée et est de 50 mV pleine déviation d'échelle quelle que soit la gamme de mesure choisie.
L'impédance de sortie est d'environ 600 Ω en série avec 47 μF.

6.6. Erreurs dues à la distorsion

Quoique le mètre indique la valeur moyenne de la tension à redressement biphasé, l'échelle de l'appareil est étalonnée en valeurs ms des tensions sinusoïdales. De ce fait, des erreurs de mesure apparaissent à la mesure de tensions non-sinusoïdales.

Les valeurs de celles-ci dépendent du coefficient de la distorsion linéaire.

7. CIRCUIT DESCRIPTION

7.1. Measuring section

Input circuit, fig. 6

The test voltage connected to X1 is supplied to the impedance transformer stage via C1 and S 101/1f and S 101/2r (direct input) or via S 101/1f; R1...R4; C4...C6; C50...C56 and S 101/2r (via high ohmic, frequency-independent 1000:1 attenuator).
In both cases the input capacitance is equalised by means of C3, so that a possible probe (PM 9336) can be used in every test area.

Impedance transformation circuit, fig. 7

This circuit consists of a two-stage amplifier V5 and V6, the output signal of which is fully fed back.
Thus a stable single amplifier with a low output impedance is obtained.

For the protection of the field effect transistor V5 two protective diodes V2 and V4 are provided which in the reverse direction are connected between the input and V1 and V3 respectively.
If the input voltage exceeds the zener voltage of V1,or V2 or V4 will become conductive, as a result of which the voltage on the gate of V5 is limited.
The current through the diodes is limited by the impedance of the input circuit R 106–R 7 and C8. In the voltage divider that follows now and that consists of S 101/3r, R 119...R 126 and R 128...R 132 the test voltage is attenuated in steps of 10 dB. C 118 and C 119 prevent the frequency-response curve from rising.

Amplifier, fig. 8

This consists of two feedback circuits, viz. V7 with V8 and V9 with V10.
A d.c. feedback from nodal point R40 and R41 via R31 to the base of V7 is wired across the whole assembly.
The amplification of the first circuit is determined by R34 and R35 and that of the second circuit by R38 and R37.
The RC network R33 and C22 blocks oscillations from the first circuit.

AC–DC converter, fig. 9, 10

This converter contains the amplifier stages V12 and V15 with V16 coupled by the emitter-follower V14 and the current source V18.
Test resistor R65 is included in the feedback network together with the rectifier circuit.
V15 and V16 together constitute an amplifier stage in cascode arrangement. Thus feedback from the output signal to the input of this amplifier stage is avoided.

By means of a differential amplifier A2 the operating point of V16 compared with the voltage obtained from voltage divider R58 – R59. A possible deviating voltage is amplified and fed back to the base of V12 so that the voltage is corrected. The voltage on the collector of V16 has been chosen so that it is equal to the emitter voltage plus half the knee voltage of V19 and V20; consequently the latter diodes can never become conductive on account of a voltage difference between the collector of V16 and the emitter of V12.
To prevent the a.c. signal from the collector of V16 from being fed back to the base of V12 via the differential amplifier, C33 has been applied across this amplifier. As a result of this the variable-gain amplifier behaves as an integrator with a time constant governed by C33 and R56. The property of this integrator is that it passes on signal with frequencies below $f = \frac{1}{2\pi .\ RC}$ after amplification, but attenuates signals strongly if their frequency is higher.

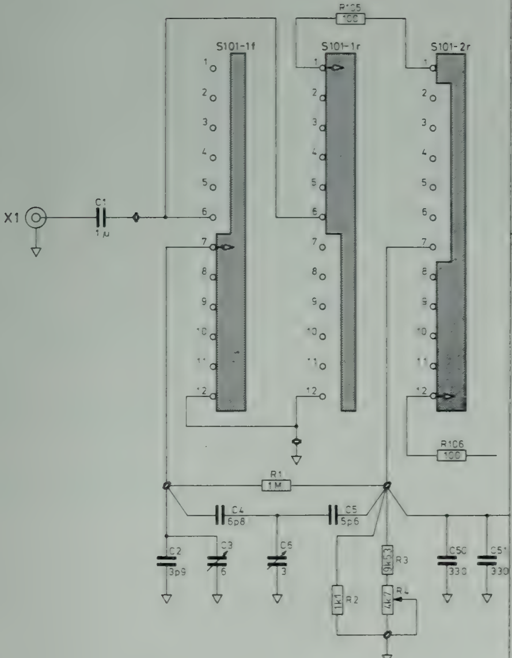

Fig. 6. Input circuit.

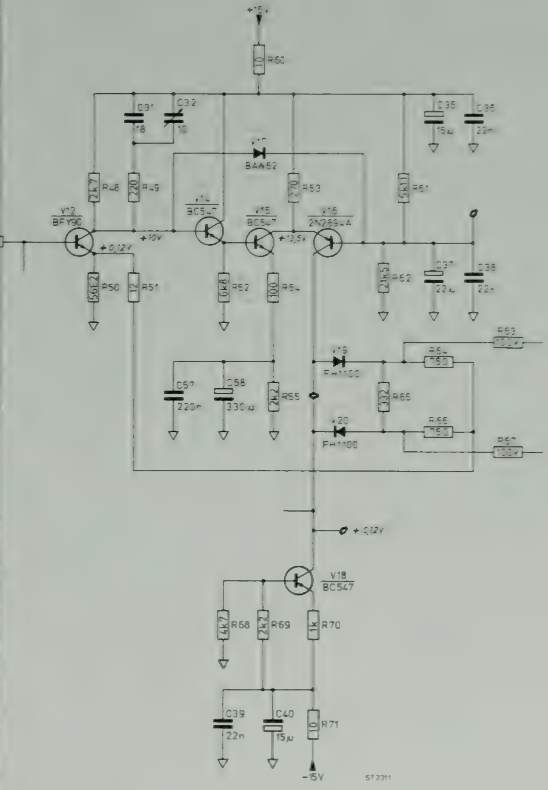

Fig. 9. AC - DC Converter

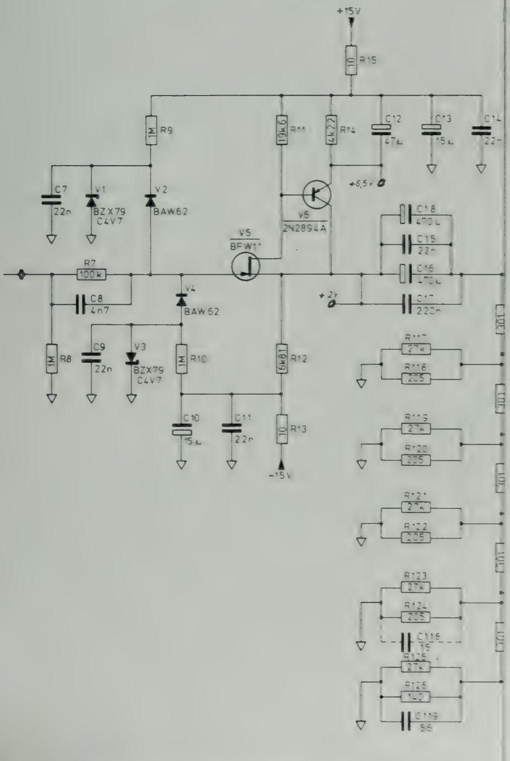

Fig. 7. Impedance transformation circuit

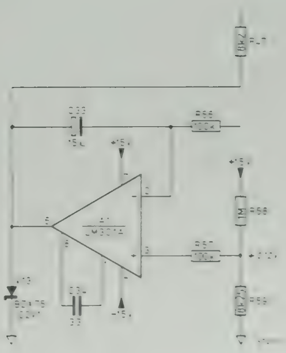

Fig. 10. Feedback circuit

7. CIRCUIT DESCRIPTION

7.1. Measuring section

Input circuit, fig. 6

The test voltage connected to X1 is supplied to the impedance transformer stage via C1 and S 101/1f and S 101/2r (direct input) or via S 101/1f; R1...R4; C4...C6; C50...C56 and S 101/2r (via high ohmic, frequency-independent 1000:1 attenuator).
In both cases the input capacitance is equalised by means of C3, so that a possible probe (PM 9336) can be used in every test area.

Impedance transformation circuit, fig. 7

This circuit consists of a two-stage amplifier V5 and V6, the output signal of which is fully fed back.
Thus a stable single amplifier with a low output impedance is obtained.

For the protection of the field effect transistor V5 two protective diodes V2 and V4 are provided which in the reverse direction are connected between the input and V1 and V3 respectively.
If the input voltage exceeds the zener voltage of V1, or V2 or V4 will become conductive, as a result of which the voltage on the gate of V5 is limited.
The current through the diodes is limited by the impedance of the input circuit R 106–R 7 and C8. In the voltage divider that follows now and that consists of S 101/3r, R 119...R 126 and R 128...R 132 the test voltage is attenuated in steps of 10 dB. C 118 and C 119 prevent the frequency-response curve from rising.

Amplifier, fig. 8

This consists of two feedback circuits, viz. V7 with V8 and V9 with V10.
A d.c. feedback from nodal point R40 and R41 via R31 to the base of V7 is wired across the whole assembly.
The amplification of the first circuit is determined by R34 and R35 and that of the second circuit by R38 and R37.
The RC network R33 and C22 blocks oscillations from the first circuit.

AC–DC converter, fig. 9, 10

This converter contains the amplifier stages V12 and V15 with V16 coupled by the emitter-follower V14 and the current source V18.
Test resistor R65 is included in the feedback network together with the rectifier circuit.
V15 and V16 together constitute an amplifier stage in cascode arrangement. Thus feedback from the output signal to the input of this amplifier stage is avoided.

By means of a differential amplifier A2 the operating point of V16 compared with the voltage obtained from voltage divider R58 – R59. A possible deviating voltage is amplified and fed back to the base of V12 so that the voltage is corrected. The voltage on the collector of V16 has been chosen so that it is equal to the emitter voltage plus half the knee voltage of V19 and V20; consequently the latter diodes can never become conductive on account of a voltage difference between the collector of V16 and the emitter of V12.
To prevent the a.c. signal from the collector of V16 from being fed back to the base of V12 via the differential amplifier, C33 has been applied across this amplifier. As a result of this the variable-gain amplifier behaves as an integrator with a time constant governed by C33 and R56. The property of this integrator is that it passes on signal with frequencies below $f = \frac{1}{2\pi . RC}$ after amplification, but attenuates signals strongly if their frequency is higher.

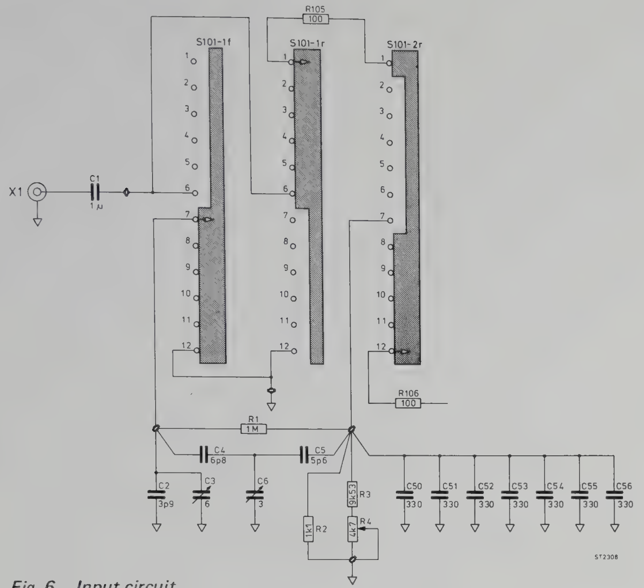

Fig. 6. Input circuit.

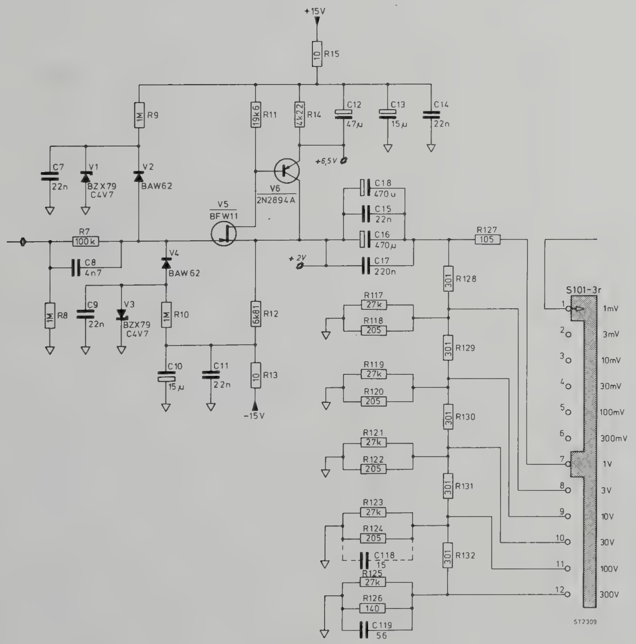

Fig. 7. Impedance transformation circuit

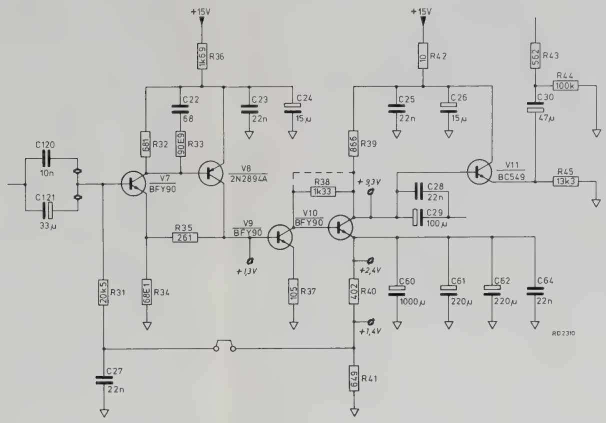

Fig. 8. AC Amplifier

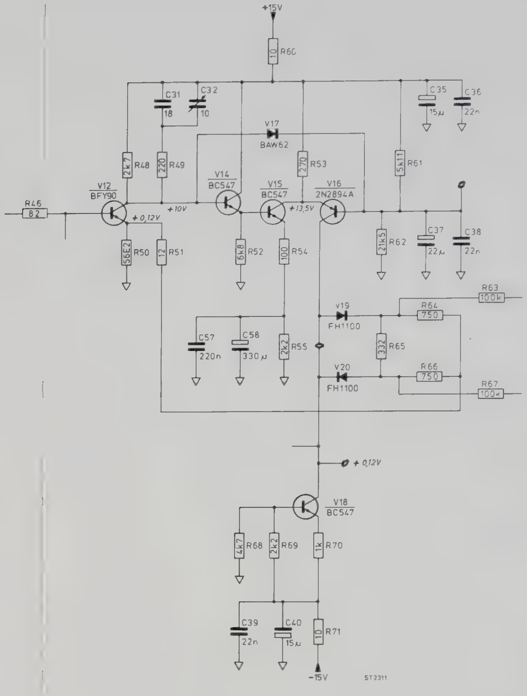

Fig. 9. AC - DC Converter

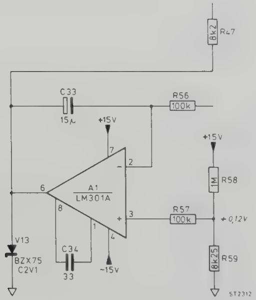

Fig. 10. Feedback circuit

DC amplifier, fig. 11

The dc voltage which appears over the measuring resistor R65 is fed via resistors R63 and R67 which, together with the resistors R27 and R73 determine the amplification factor (X1) for dc signals. The ripple voltage at the output of the amplifier A2 is suppressed by the capacitors C45 and C42 and the resistor R73.
Owing to the circuit arrangement by which capacitors C45 and 42 can be switched using S 102 the ripple suppression is also effective at very low frequencies. At the same time the meter response is damped so that unwanted virbration of the meter needle is reduced. The offset voltage for A2 is determined by resistor R91.

7.2. Supply section, fig. 12

The two primary windings S1 and S2 of transformer T1 can be connected in series or in parallel by connecting together the appropriate soldering pins.

For mains voltages between 180 and 265 volts the windings must be connected in series and for voltages between 90 and 132 volts in parallel.

The output of T1 is rectified by V21 and smoothed by C46.

The current source consisting of V23–26 and R84 delivers the current for the equipment and at the same time provides a stabilized supply voltage via zener diodes V24 and V25.

The adjusting current for V23 is delivered by the current source consisting of V22–25 and R83.

R82 is the starting resistor for both current sources.

7.3. Reference voltage generator, fig. 13

The generator consists of a CMOS circuit with a time constant determined by R85 and C47. The supply voltage for this circuit is further stabilized by means of zener diode V27, resulting in the square wave at the output (pin 10) being extremely stable.

This voltage is applied to a potential divider consisting of resistors R86 to 89 and a proportion of it is applied to reference output X4.
Applying this voltage to the 100 mV range enables the instrument to be calibrated.

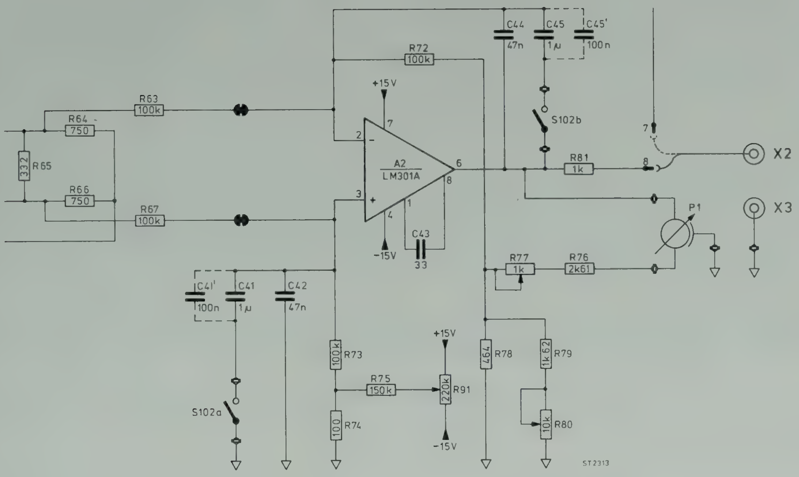

Fig. 11. DC Amplifier

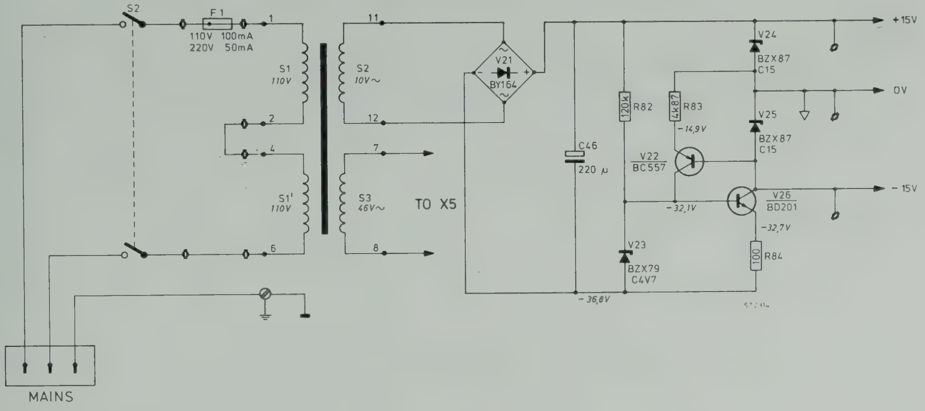

Fig. 12. Mains section

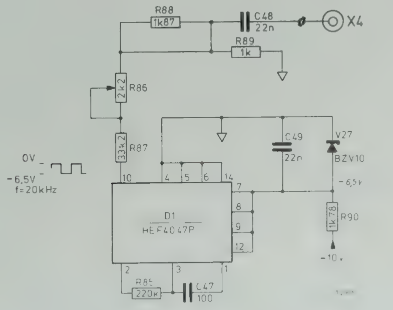

Fig. 13. Reference voltage generator

8. ACCESS

The opening of parts, or removal of covers, is likely to expose live conductors. The instrument should therefore be disconnected from all voltage sources before any opening of parts or removal of covers is started.

During and after dismantling, bear in mind that capacitors in the instrument may still be charged even if it has been separated from all voltage sources.

USE A WELL-FITTING CROSSHEAD SCREW-DRIVER TO DISMANTLE THE INSTRUMENT TO PREVENT THE CORSS-SLOTTED SCREWS FOR DAMAGE.

8.1. Dismantling

1. Top cover

- Remove both screws "A" (fig. 5)
- Lift the cover at the rear and slide it backwards from the unit.

2. Bottom cover

- Remove both screws "B" (fig. 5)
- Lift the cover at the rear and slide it backwards from the unit.

9. MAINTENANCE AND SERVICING

AC millivoltmeter PM 2554 requires no maintenance because the instrument contains no components which are subject to wear.

However, to ensure reliable and faultless operation, the instrument should not be exposed to moisture, heat, corrosive vapours and excessive dust.

9.1. Service hints

If service work must be performed, the following points should be taken into account to avoid damage of the instrument.

- In case of measurements on a switched-on instrument proceed carefully to avoid short-circuits by means of measuring clips or measuring hooks.
- For soldering use absolutely acid-free soldering tin.
- For all soldering work on the printed circuit boards, use a miniature soldering iron (35 W max.) with a thin-cleaner or a vacuum soldering iron.
- On the printed wiring boards jumpers are introduced at the conductor side; they can be used to interrupt circuits in order to test the functioning of the corresponding circuit.
- The dc settings of the instrument given on the circuit diagram are measured with the input short circuited. These values represent an average instrument.

10. CHECKING AND ADJUSTING

10.1. General

The tolerances stated in this chapter correspond to the factory data; they apply when the instrument is readjusted completely. Such data may differ from these given in chapter 2. Technical Data.

To calibrate this instrument,only reference voltages and measuring equipment with the required accuracy should be applied.

Before calibration, a warming-up time of approximately 30 minutes should be taken into account.

10.2. Survey of adjusting elements

The next table gives a survey of the adjustments and checking procedure.

For a complete adjustment adhere to the sequence of point 3 of this chapter.

Adjusting unit	Fig.	Adjustment or final adjustment	Required measuring or auxiliary instrument	Adjust according to chapter 10 sub-point
R80	18	Calibrating the instrument		3.4
R4	19	Frequency-independent voltage divider	LF generator precision LF millivoltmeter	3.5
R91	18	Zero point DC amplifier	Voltmeter, for instance PM 2403	3.3
R77	18	DC output	LF generator, precision LF millivoltmeter. Voltmeter, for instance PM 2421	3.4
R86	18	Reference voltage	LF generator, precision LF millivoltmeter	3.6
C3/C6	18	Frequency-independent voltage divider	LF generator, precision LF millivoltmeter. Probe PM 9336	3.5

10.3 Adjusting procedure

10.3.1. Mechanical zero-setting

- Check with the unit switched off whether the mechanical zero adjustment of the pointer is correct. Deviations can be corrected by means of the correction screw. The unit should be placed horizontal in this case.

10.3.2. Supply voltages

- The value adjusted by means of the wiring of T1 (see fig. 3) must correspond with the local mains voltage
- The mains fuse must have a current value of 50 mA d.a. (90 V...132 V) or 100 mA d.a. (180 V...265 V)
- The supply voltages are + 15 V and – 15 V with respect to 0

  Test points + 15 V: cathode V24
  0 V: cathode V25
  – 15 V: anode V25

10.3.3. Zero-setting d.c. amplifier

- Set S 101 to position 300 mV
- Measure the voltage on the d.c. output
- Adjust this voltage to 0 V by means of potentiometer R91
- Set S 101 to position 1 mV
- The pre-deflection must be less than 3 scale devisions (sd.)

10.3.4. Adjusting the d.c. output

- Set S 101 to position 30 mV
- Connect a voltage of 31.6 mV ± 0.2%; 1 kHz to X1
- Adjust the test system to 100 sd by means of R80
- Measure the voltage on the d.c. output X2 and X3
- Adjust the voltage to 1 V ± 0.2% by means of R77

10.3.5. Adjusting the frequency-independent voltage divider

- Set S 101 to position 10 V
- Connect a voltage of 10 V ± 0.2% 400 Hz to X1
- Adjust the test system to 100 sd by means of R4
- Increase the frequency to 50 kHz
- Adjust the test system to 100 sd by means of C6
- Set S 101 to position 100 mV
- Connect a voltage of 1 V ± 0.2% to X1 via a PM 9336 probe
- Note down the deflection of the test system.
- Increase the frequency to 50 kHz
- Adjust the system to the value noted by means of the trimming potentiometer in the probe
- Set S 101 to position 1 V
- Connect a voltage of 10 V ± 0.2%, 200 Hz to X1 via the probe now adjusted
- Noted down the deflection of the test system
- Increase the frequency to 50 kHz
- Adjust the system to the latter value by means of C3.

10.3.6. Adjusting the reference generator

- Set S 101 in position 100 mV
- Apply a voltage of 100 mV ± 0.2% 1 kHz to X1
- Adjust the test system to 100 sd by means of R80
- Interconnect X1 and X4
- Adjust the test system to 100 sd by means of R86

10.3.7. Ripple suppression

(Only necessary if C41 or C45 has to be replaced)

- Set S 101 in position 1 V
- Set S 102 in position slow
- Connect a voltage of 0.9 V 2 Hz to X1
- The total swing of the needle should be smaller than 0.5 sd
- If necessary add a capacitor of 0.1 μF in parallel with R41 or R45

10.3.8. Final check

After the above adjustments, the instrument must comply with the specifications given in the table below.

Position S 101	Supply			Indication in sd test system	D.C. Output
10 mV	10	mV	10 kHz	100 ± 1.5%	1 V ± 1.5%
30 mV	31.6	mV	10 kHz	100 ± 1.5%	1 V ± 1.5%
100 mV	100	mV	10 kHz	100 ± 1.5%	1 V ± 1.5%
100 mV	100	mV	400 kHz	100 ± 1.5%	1 V ± 1.5%
100 mV	100	mV	10 Hz	100 ± 1.5%	1 V ± 1.5%
100 mV	100	mV	2 Hz	100 ± 3.5%	1 V ± 3.5%
100 mV	100	mV	2 MHz	100 ± 2 %	1 V ± 2.5%
100 mV	100	mV	6 MHz	100 ± 4 %	1 V ± 4 %
100 mV	100	mV	12 MHz	100 ± 7 %	1 V ± 7 %
1 V	1	V	10 kHz	100 ± 1.5%	1 V ± 1.5%
1 V	1	V	12 MHz	100 ± 7 %	1 V ± 7 %
3 V	3.16	V	10 kHz	100 ± 1.5%	1 V ± 1.5%
10 V	10	V	10 kHz	100 ± 1.5%	1 V ± 1.5%

Note:— Accuracy of the voltage supplied: + 0.5%

— In case of a to high indication at 2 Hz C60 should be increased or C16 should be decreased.

11. LIST OF PARTS

11.1 Mechanical

Item	Fig.	Qty.	Ordering number	Description
1	14	1	5322 447 94068	Top and bottom cover
2	14	2	5322 460 64003	Ornamental strip
3	14	2	5322 535 74367	Spindle for handle
4	14	1	5322 520 34138	Bearing bush, left
5	17	1	5322 520 34139	Bearing bush, right
6	14	1	5322 498 74003	Cab for handle
7	14	1	5322 498 54032	Handle assey
8	14	1	5322 460 64002	Ornamental frame
9	16	1	5322 414 64039	Knob for S 101
10	14	1	5322 414 74019	Cab for knob
11	14	1	5322 526 44136	Insulating bush
12	17	1	5322 405 94159	Clip
13	16	1	5322 532 54209	Coppling piece
14	14	1	5322 535 74394	Spindle
15	17	1	5322 535 94637	Extension spindle
16	16	1	5322 532 64119	Bush
17	16	2	5322 462 44175	Foot
18	17	1	5322 492 64337	Retaining spring
19	15	4	5322 462 44121	Foot

11.2 Miscellaneous

Item	Fig.	Qty.	Ordering number	Description
20	16	1	4822 253 30003	Fuse 50 mA da 5 x 20
21	14	1	5322 267 14022	Measuring system
22	17	1	5322 276 14085	Fast-Slow switch
23	17	1	4822 276 10554	Mains switch
24	16	1	5322 273 64036	Range switch
25	16	1	5322 146 24186	Mains transformer
26	14	1	5322 267 14022	HF-Con BNC
27	15	1	5322 267 30231	Connector Hi
28	15	1	5322 267 30231	Connector Lo
29	15	1	5322 267 30231	Connector REF
30	15	1	5322 267 54072	Connector 8–P
31	–	1	5322 320 14093	Measuring cable
32	16	2	4822 253 30006	Fuse 100 mA da 5 x 20
33	14	2	5322 414 14011	Push botton knob
34	15	1	5322 321 14001	Mains cable
35	15	1	5322 325 50101	Cable grommet
36	16	1	5322 462 44362	Protective cover

11. LIST OF PARTS

11.1 Mechanical

Item	Fig.	Qty.	Ordering number	Description
1	14	1	5322 447 94068	Top and bottom cover
2	14	2	5322 460 64003	Ornamental strip
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6	14	1	5322 498 74003	Cab for handle
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8	14	1	5322 460 64002	Ornamental frame
9	16	1	5322 414 64039	Knob for S 101
10	14	1	5322 414 74019	Cab for knob
11	14	1	5322 526 44136	Insulating bush
12	17	1	5322 405 94159	Clip
13	16	1	5322 532 54209	Coppling piece
14	14	1	5322 535 74394	Spindle
15	17	1	5322 535 94637	Extension spindle
16	16	1	5322 532 64119	Bush
17	16	2	5322 462 44175	Foot
18	17	1	5322 492 64337	Retaining spring
19	15	4	5322 462 44121	Foot

11.2 Miscellaneous

Item	Fig.	Qty.	Ordering number	Description
20	16	1	4822 253 30003	Fuse 50 mA da 5 x 20
21	14	1	5322 267 14022	Measuring system
22	17	1	5322 276 14085	Fast-Slow switch
23	17	1	4822 276 10554	Mains switch
24	16	1	5322 273 64036	Range switch
25	16	1	5322 146 24186	Mains transformer
26	14	1	5322 267 14022	HF-Con BNC
27	15	1	5322 267 30231	Connector Hi
28	15	1	5322 267 30231	Connector Lo
29	15	1	5322 267 30231	Connector REF
30	15	1	5322 267 54072	Connector 8–P
31	–	1	5322 320 14093	Measuring cable
32	16	2	4822 253 30006	Fuse 100 mA da 5 x 20
33	14	2	5322 414 14011	Push botton knob
34	15	1	5322 321 14001	Mains cable
35	15	1	5322 325 50101	Cable grommet
36	16	1	5322 462 44362	Protective cover

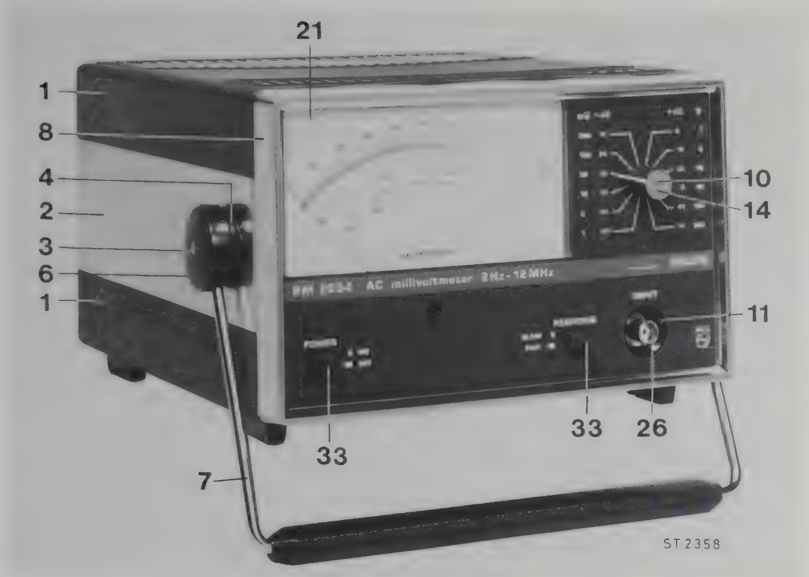


Fig. 14. Front view with item numbers

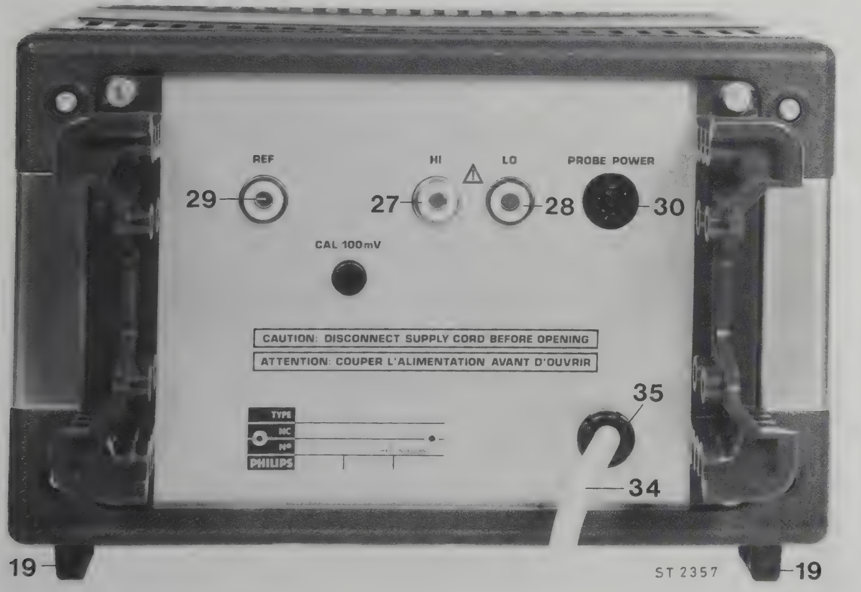

REF
HI
LO
PROBE POWER
29
27
28
30
CAL 100mV
CAUTION: DISCONNECT SUPPLY CORD BEFORE OPENING
ATTENTION: COUPER L'ALIMENTATION AVANT D'OUVRIR
TYPE
NC
Nº
PHILIPS
35
34
19
19
ST 2357

Fig. 15. Rear view with item numbers

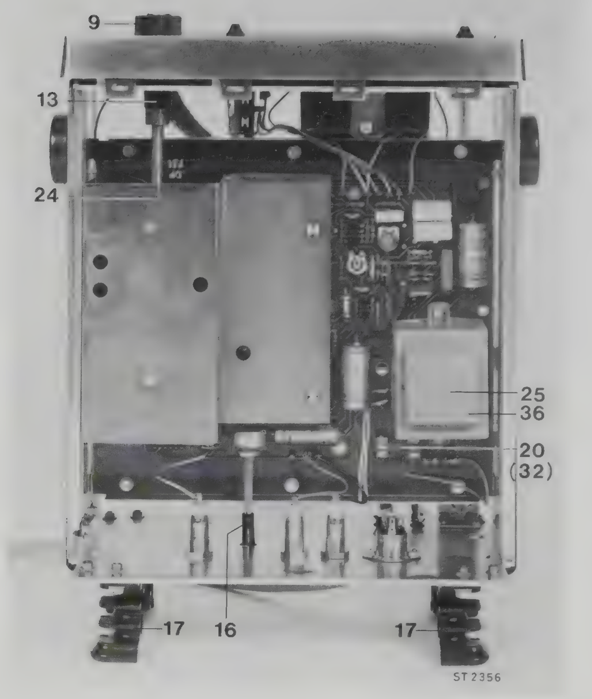


Fig. 16. Top view

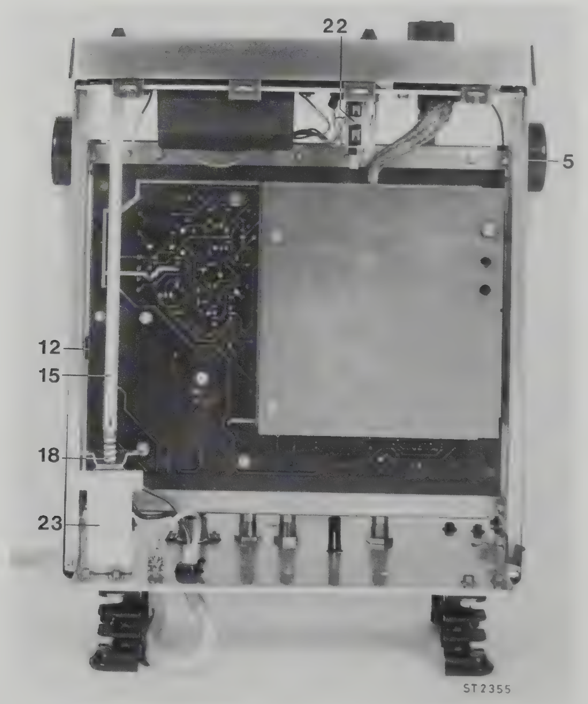


Fig. 17. Bottom view

11.3. Electrical

11.3.1. Resistors *

No.	Ordering number	Value (Ω)	%	Series
R 1	5322 116 54188	1 M	1	MR30
R 2	5322 116 54554	1,1 k	1	MR25
R 3	5322 116 54617	9,53 k	1	MR25
R 4	4822 101 20416	4,7 k	20	0.1W Potentiometer
R 7	4822 116 51123	100 k	1	MR30
R 8	5322 116 54188	1 M	1	MR30
R 11	5322 116 54641	19,6 k	1	MR25
R 12	5322 116 54012	6,81 k	1	MR25
R 13	5322 116 50452	10	1	MR25
R 14	5322 116 50729	4,22 k	1	MR25
R 15	5322 116 50452	10	1	MR25
R 31	5322 116 54643	20,5 k	1	MR25
R 32	5322 116 54534	681	1	MR25
R 33	5322 116 54466	90,9	1	MR25
R 34	5322 116 54455	68,1	1	MR25
R 35	5322 116 54502	261	1	MR25
R 36	5322 116 54567	1,69 k	1	MR25
R 37	5322 116 54472	105	1	MR25
R 38	5322 116 54561	1,33 k	1	MR25
R 39	5322 116 54543	866	1	MR25
R 40	5322 116 54519	402	1	MR25
R 41	5322 116 54532	649	1	MR25
R 42	5322 116 50452	10	1	MR25
R 43	5322 116 54009	562	1	MR25
R 44	5322 116 54696	100 k	1	MR25
R 45	5322 116 54627	13,3 k	1	MR25
R 50	5322 116 54446	56,2	1	MR25
R 57	5322 116 54696	100 k	1	MR25
R 58	5322 116 54188	1 M	1	MR30
R 59	5322 116 54558	8,25 k	1	MR25
R 61	5322 116 54595	5,11 k	1	MR25
R 62	5322 116 50451	21,5 k	1	MR25
R 63	5322 116 54696	100 k	1	MR25
R 64	5322 116 54536	750	1	MR25
R 65	5322 116 54513	332	1	MR25
R 66	5322 116 54536	750	1	MR25
R 67	5322 116 54696	100 k	1	MR25
R 72	5322 116 54696	100 k	1	MR25
R 73	5322 116 54696	100 k	1	MR25
R 74	5322 116 54469	100	1	MR25

* Carbon resistors CR25 5% –0,125 W are not mentioned in this list

No.	Ordering number	Value (Ω)	%	Series	
R 76	5322 116 50671	2,61 k	1	MR25	
R 77	4822 100 10037	1 k	20	0,05W	Potentiometer
R 78	5322 116 50536	464	1	MR25	
R 79	5322 116 54565	1,62 k	1	MR25	
R 80	5322 101 24138	10 k	20	MR25	
R 81	5322 116 54549	1 k	1	MR25	
R 83	5322 116 50509	4,87 k	1	MR25	
R 84	5322 116 54469	100	1	MR25	
R 86	4822 100 10029	2,2 k	20	0,05W	Potentiometer
R 87	5322 116 50482	33,2 k	1	MR25	
R 88	5322 116 50728	1,87 k	1	MR25	
R 89	5322 116 54549	1 k	1	MR25	
R 90	5322 116 50729	4,22 k	1	MR25	
R 91	4822 100 10088	220 k	20	0,05W	Potentiometer
R 105	5322 116 54852	100	1	MR30	
R 106	5322 116 54852	100	1	MR30	
R 118	5322 116 54767	205	0,25	MR24C	
R 120	5322 116 54767	205	0,25	MR24C	
R 122	5322 116 54767	205	0,25	MR24C	
R 123	4822 110 63145	27 k	5	CR25	
R 124	5322 116 54767	205	0,25	MR24C	
R 126	5322 116 50865	140	0,25	MR24C	
R 127	5322 116 54472	105	1	MR25	
R 128	5322 116 55038	301	0,25	MR24C	
R 129	5322 116 55038	301	0,25	MR24C	
R 130	5322 116 55038	301	0,25	MR24C	
R 313	5322 116 55038	301	0,25	MR24C	
R 132	5322 116 55038	301	0,25	MR24C	

11.3.2. Capacitors

No.	Ordering number	Value (F)	%	V	Description
C 1	4822 121 40117	1 µ	10	400	Polyester
C 2	4822 122 31217	3,9 p	0,25pF		Ceramic
C 3	4822 125 60037	6		500	Trimmer
C 4	4822 122 31192	6,8 p	0,25pF	500	Ceramic
C 5	4822 122 31191	5,6 p	0,25pF	500	Ceramic
C 6	5322 125 64011	3 p		500	Trimmer
C 7	4822 122 30103	22 n	–20+80	40	Ceramic
C 8	5322 121 44225	4,7 n	10	630	Polyester
C 9	4822 122 30103	22 n	–20+80	40	Ceramic
C 10	4822 124 20467	15 µ	–10+50	16	Electrolytic
C 11	4822 122 30103	22 n	–20+80	40	Ceramic
C 12	4822 124 20461	47 µ	–10+50	10	Electrolytic
C 13	4822 124 20467	15 µ	–10+50	16	Electrolytic
C 14	4822 122 30103	22 n	–20+80	40	Ceramic
C 15	4822 122 30103	22 n	–20+80	40	Ceramic
C 16	4822 124 20457	470 µ	–10+50	6,3	Electrolytic
C 17	4822 121 40232	220 n	10	100	Polyester
C 18	4822 124 20457	470 µ	–10+50	6,3	Electrolytic
C 22	4822 122 31076	68 p	2	100	Ceramic
C 23	4822 122 30103	22 n	–20+80	40	Ceramic
C 24	4822 124 20467	15 µ	–10+50	16	Electrolytic
C 25	4822 122 30103	22 n	–20+80	40	Ceramic
C 26	4822 124 20467	15 µ	–10+50	16	Electrolytic
C 27	4822 122 30103	22 n	–20+80	40	Ceramic
C 28	4822 122 30103	22 n	–20+80	40	Ceramic
C 29	4822 124 20462	100 µ	–10+50	10	Electrolytic
C 30	4822 124 20461	47 µ	–10+50	10	Electrolytic
C 31	4822 122 31061	18 p	2	100	Ceramic
C 32	4822 125 50062	10 p		250	Trimmer
C 33	4822 124 20467	15 µ	–10+50	16	Electrolytic
C 34	4822 122 31067	33 p	2	100	Ceramic
C 35	4822 124 20467	15 µ	–10+50	16	Electrolytic
C 36	4822 122 30103	22 n	–20+80	40	Ceramic
C 37	4822 124 20459	22 µ	–10+50	10	Electrolytic
C 38	5322 121 40308				Polyester
C 39	4822 122 30103	22 n	–20+80	40	Ceramic
C 40	4822 124 20467	15 µ	–10+50	16	Electrolytic
C 41	5322 121 40197	1 µ	10	100	Polyester
C 42	5322 121 44138	47 n	10	100	Polyester
C 43	4822 122 31067	33 p	2	100	Ceramic
C 44	5322 121 44138	47 n	10	100	Polyester
C 45	5322 121 40197	1 µ	10	100	Polyester
C 46	4822 124 20537	220 µ	–10+50	63	Electrolytic
C 47	4822 122 31081	100 p	2	100	Ceramic
C 48	4822 122 30103	22 n	–20+80	40	Ceramic

No.	Ordering number	Value (F)		%	V	Description
C 49	4822 122 30103	22	n	−20+80	40	Ceramic
C 50	4822 122 30055	330	p	−20+80	100	Ceramic
C 51	4822 122 30055	330	p	2	100	Ceramic
C 52	4822 122 30055	330	p	2	100	Ceramic
C 53	4822 122 30055	330	p	2	100	Ceramic
C 54	4822 122 30055	330	p	2	100	Ceramic
C 55	4822 122 30055	330	p	2	100	Ceramic
C 56	4822 122 30055	330	p	2	100	Ceramic
C 57	4822 121 40232	220	n	10	100	Polyester
C 58	4822 124 20465	330	μ	−10+50	10	Electrolytic
C 60	4822 124 20508	1000	μ	−10+50	4	Electrolytic
C 61	4822 124 20581	220	μ	−10+50	4	Electrolytic
C 62	4822 124 20515	2200	μ	−10+50	6,3	Electrolytic
C 64	4822 122 30103	22	n	−20+80	40	Ceramic
C 118	4822 122 31058	15	p	2	100	Ceramic
C 119	4822 122 31074	56	p	2	100	Ceramic
C 121	4822 124 20468	33	μ	−10+50	16	Electrolytic

11.3.3. Semiconductors

No.	Ordering number	Type
V 1	5322 130 34174	BZX79–C4V7
V 2	4822 130 30613	BAW62
V 3	5322 130 34174	BZX79–C4V7
V 4	4822 130 30613	BAW62
V 5	5322 130 40408	BFW11
V 6	5322 130 44127	2N2894A
V 7	5322 130 40493	BFY90
V 8	5322 130 44127	2N2894A
V 9	5322 130 40493	BFY90
V 10	5322 130 40493	BFY90
V 11	4822 130 40964	BC549
V 12	5322 130 40493	BFY90
V 13	5322 130 34049	BZX75–C2V1
V 14	4822 130 44257	BC547
V 15	4822 130 44257	BC547
V 16	5322 130 44127	2N2894A
V 17	4822 130 30613	BAW62
V 18	4822 130 44257	BC547
V 19	5322 130 34062	FH1100
V 20	5322 130 34062	FH1100
V 21	4822 130 30414	BY164
V 22	4822 130 44256	BC557
V 23	5322 130 34174	BZX79–C4V7
V 24	5322 130 34156	BZX87–C15
V 25	5322 130 34156	BZX87–C15
V 26	5322 130 44325	BD201 (TO220)
V 27	5322 130 34439	BZV10

11.3.4. Integrated circuits

No.	Ordering number	Type
D 1	5322 209 14125	HEF 4047BP
A 1	5322 209 84679	LM301AN
A 2	5322 209 84679	LM301AN

CODING SYSTEM OF FAILURE REPORTING FOR QUALITY ASSESSMENT OF T & M INSTRUMENTS

(excl. potentiometric recorders)

The information contents of the coded failure description is necessary for our computerized processing of quality data.

Since the reporting of repair and maintenance routines must be complete and exact, we give you an example of a correctly filled-out PHILIPS SERVICE Job sheet.

① *Country*	② *Day Month Year*	③ *Typenumber /Version*	④ *Factory/Serial no.*
32	150475	0PM326002	DO00783

CODED FAILURE DESCRIPTION ⑥

⑤ *Nature of call*	*Location*	*Component/sequence no.*	*Category*
☐ Installation		TS0607	5
☐ Pre sale repair		R00631	2
☐ Preventive maintenance	0021	990001	4
☒ Corrective maintenance			
☐ Other			

⑦ *Job completed* ☒

Working time ⑧ ☐☐12 Hrs

Detailed description of the information to be entered in the various boxes:

①Country: 32 = Switzerland

②Day Month Year 150475 = 15 April 1975

③Type number/Version OPM326002 = Oscilloscope PM 3260, version 02 (in later oscilloscopes this number is placed in front of the serial no)

④Factory/Serial number DO00783 = DO 783 These data are mentioned on the type plate of the instrument

⑤Nature of call: Enter a cross in the relevant box

⑥Coded failure description

Location

☐☐☐☐

These four boxes are used to isolate the problem area. Write the code of the part in which the fault occurs, e.g. unit no or mechanical item no of this part (refer to 'PARTS LISTS' in the manual).

Example: 0001 for Unit 1
000A for Unit A
0075 for item 75

If units are not numbered, do not fill in the four boxes; see Example Job sheet.

Component/sequence no.

☐☐☐☐☐☐

These six boxes are intended to pinpoint the faulty component.

A. Enter the component designation as used in the circuit diagram. If the designation is alfa-numeric, the letters must be written (starting from the left) in the two left-hand boxes and the figures must be written (in such a way that the last digit occupies the right-most box) in the four right-hand boxes.

B. Parts not identified in the circuit diagram:

990000	Unknown/Not applicable
990001	Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
990002	Knob (incl. dial knob, cap, etc.)
990003	Probe (only if attached to instrument)
990004	Leads and associated plugs
990005	Holder (valve, transistor, fuse, board, etc.)
990006	Complete unit (p.w. board, h.t. unit, etc.)
990007	Accessory (only those without type number)
990008	Documentation (manual, supplement, etc.)
990009	Foreign object
990099	Miscellaneous

Category

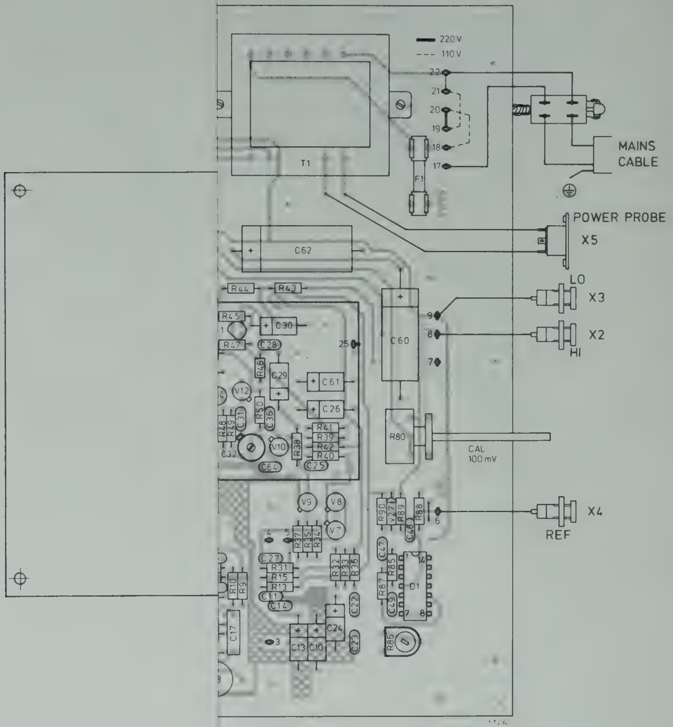
☐

0 Unknown, not applicable (fault not present, intermittent or disappeared)
1 Software error
2 Readjustment
3 Electrical repair (wiring, solder joint, etc.)
4 Mechanical repair (polishing, filing, remachining, etc.)
5 Replacement (of transistor, resistor, etc.)
6 Cleaning and/or lubrication
7 Operator error
8 Missing items (on pre-sale test)
9 Environmental requirements are not met

⑦Job completed: Enter a cross when the job has been completed.

⑧Working time: Enter the total number of working hours spent in connection with the job (excluding travelling, waiting time, etc.), using the last box for tenths of hours.

☐☐12 = 1,2 working hours (1 h 12 min.)



nponent side

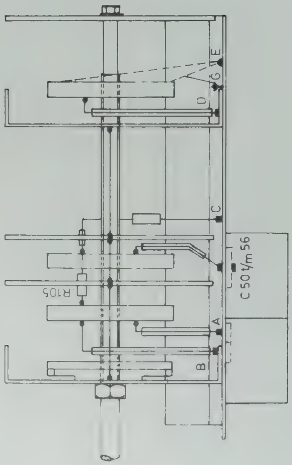
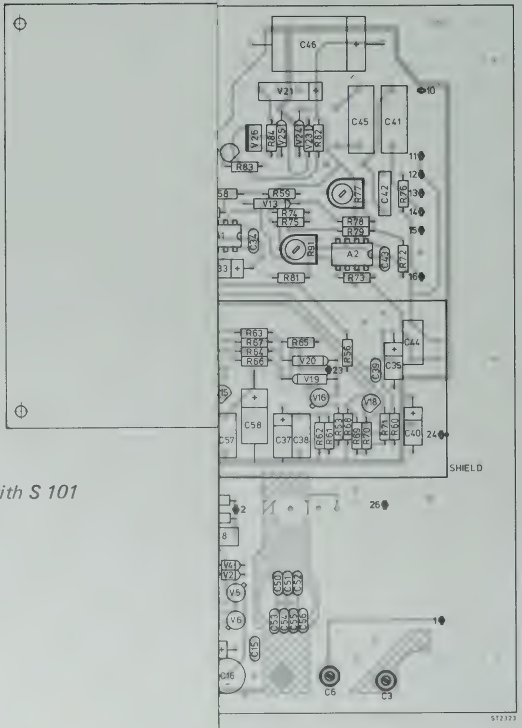
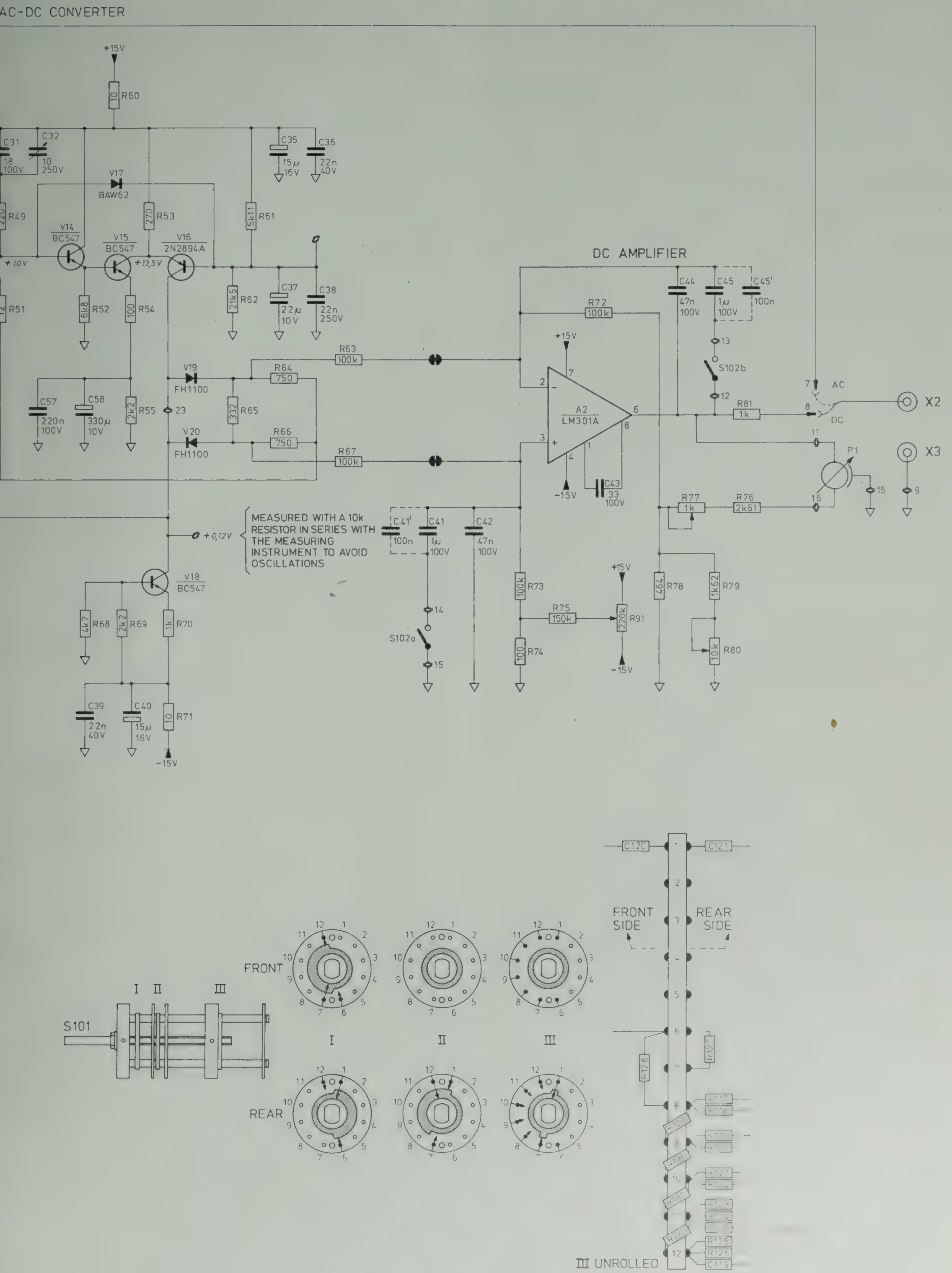


Fig. 20. Printed circuit board U1 with S 101



ductor side



MEASURED WITH A 10k RESISTOR IN SERIES WITH THE MEASURING INSTRUMENT TO AVOID OSCILLATIONS

Fig. 21. Circuit diagram.

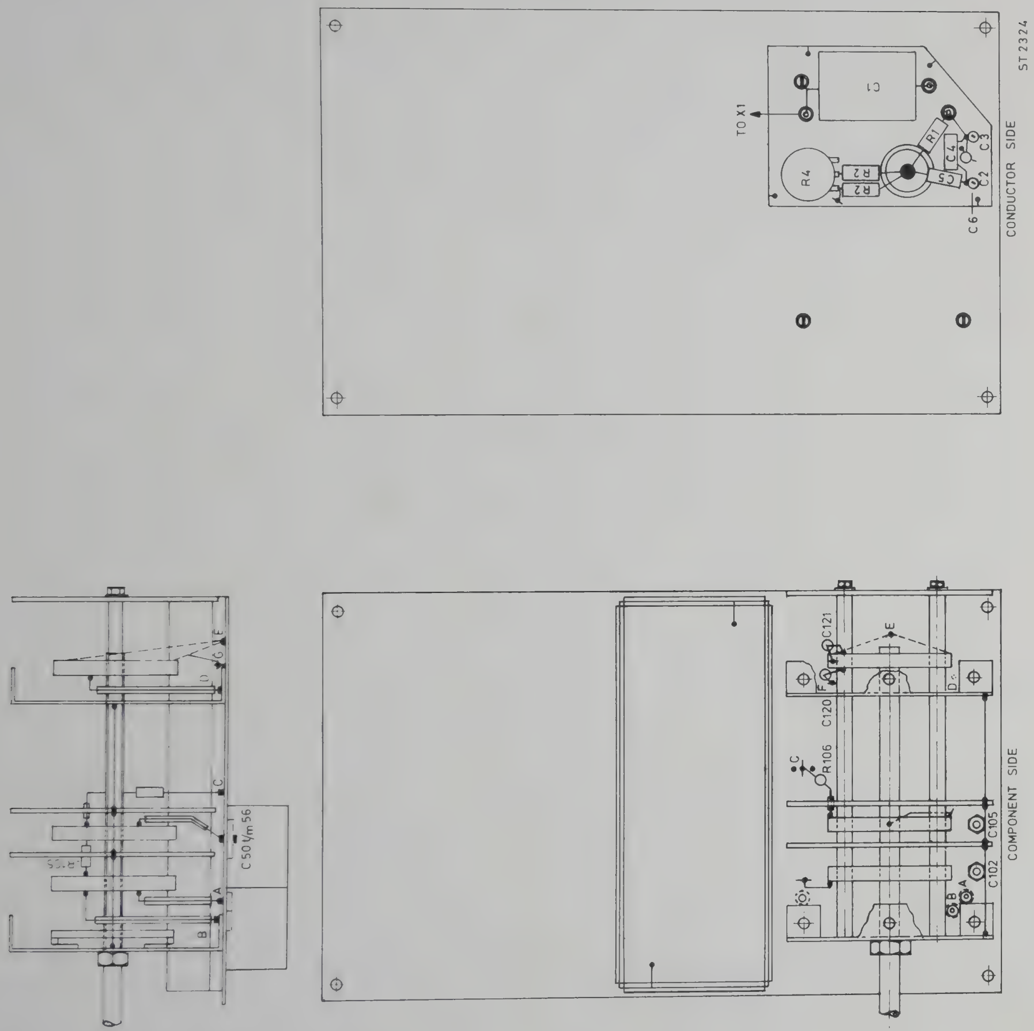


Fig. 20. *Printed circuit board U1 with S 101*

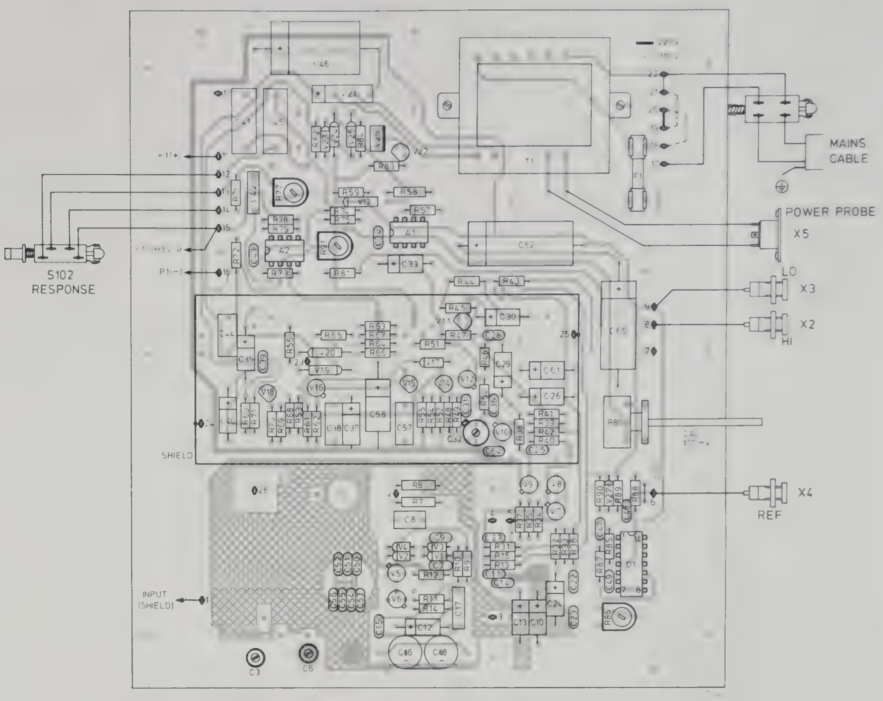


Fig. 18. *Printed circuit board U1 Component side*

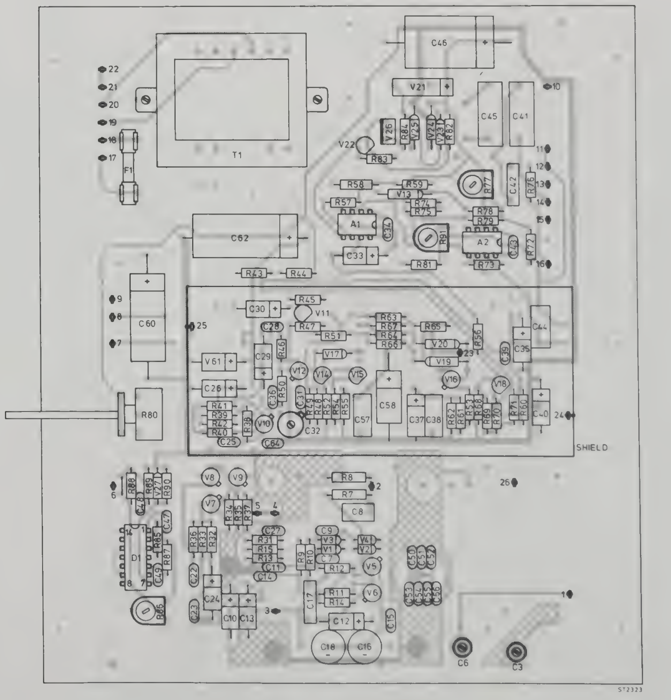


Fig. 19. *Printed circuit board U1 Conductor side*

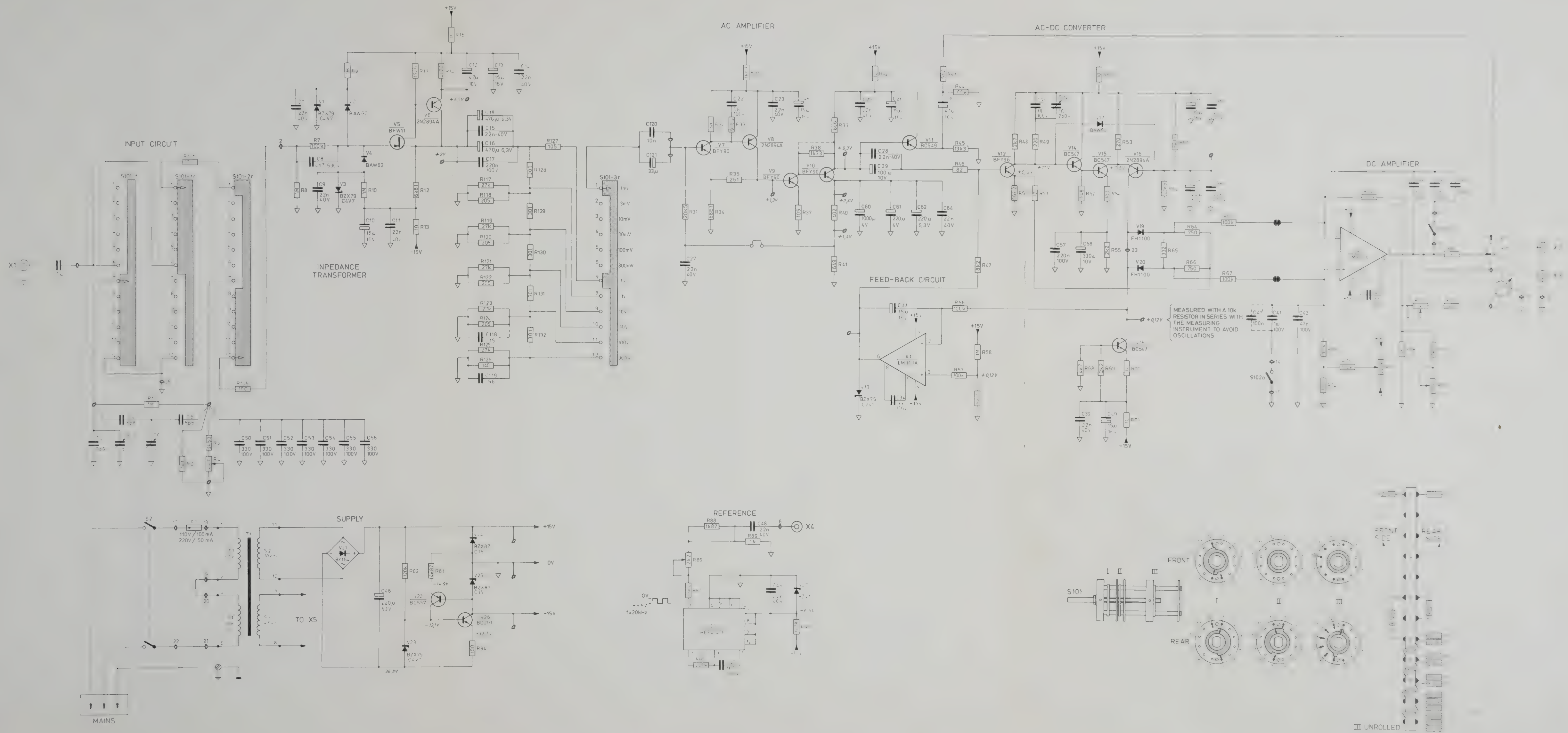


Fig. 21. Circuit diagram.

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PHILIPS

Instruction Manual

AC-millivoltmeter

PM2554

9447 025 541.1

NOTE

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NOTE:

The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.

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1. INTRODUCTION

The Philips AC millivoltmeter PM 2554 is a sensitive and accurate measuring instrument suitable for floating measurements from 50 μV up to 300 V in the frequency range from 2 Hz up to 12 MHz.
The instrument can be powered by mains.
By the very great bandwidth and sensitivity the instrument has a width range of applications, e.g. measurements on LF and HF amplifiers, carrier-wave telephony, electro-acoustical as well as for measurements on transducers and measuring-transformers, etc.

The d.c. or a.c. output choosen by an internal jumper, makes it possible to employ the instrument as an a.c./d.c. converter or as an a.c. amplifier.
The instrument has a great indicating speed, a high temperature stability and is quickly ready for use.
The 12 measuring ranges of 1 mV up to 300 V f.s.d. overlap so that a high reading accuracy is obtained.
The moving-coil instrument is provided with a mirror scale with the ranges 0-30 and 0-100 as well as dB scale from −20 dB...+ 2 dB (total span −80 dB... + 52 dB).

By means of the measuring-probe PM 9336 the input impedance can be changed from 1 MΩ // 30 pF except capacity measuring cable (100 pF) into 10 MΩ // 11 pF to permit measurements on very high ohmic circuits.

2. TECHNICAL DATA

Properties expressed in numerical values with tolerances are guaranteed by the factory.
Numerical values without tolerances serve only for information and represent the properties of an average instrument.

2.1. Electrical

Measuring range	50 μV...300 V divided into 12 ranges from 1 mV...300 V (f.s.d.)
dB Measuring range	−80 dB...+ 52 dB (12 ranges) 0 dB = 1 mW into 600 Ω, 0.775 V
Frequency range	2 Hz...12 MHz
Input impedance	direct 1 MΩ // 33 pF with PM 9336: 10 MΩ // 11 pF
Accuracy	Frequency

10 Hz	—	400 kHz	± 1% of reading, ± 1% f.s.d.
2 Hz	—	10 Hz	± 3% of reading, ± 1% f.s.d.
400 kHz	—	2 MHz	± 2% of reading, ± 1% f.s.d.
2 MHz	—	6 MHz	± 2% of reading, ± 3% f.s.d.
6 MHz	—	12 MHz	± 4% of reading, ± 4% f.s.d.

Note: By application of probe PM 9336 the accuracy will decrease 3% of reading.

Pre-deflection	< 3 scale divisions (terminating resistance ⩽ 500 Ω) Influence on accuracy: 10% pointer deflection ⩽ 0.45% 30% pointer deflection ⩽ 0.15%
Temperature range	0...+ 45°C
Temperature coëfficient	⩽ 1°/oo/°C
Effect of mains voltage variations	Additional error of 1°/oo
Rectifying circuit for the meter section	Average value rectifier
Meter scale	Mirror scale with knife-edge pointer Calibrated in rms values of sinusoidal input voltages Linear division from 0...103 and 0...325 dB scale from –20 dB...+ 2 dB
Overload protection	In the ranges 1 mV to 300 mV: 300 V for frequencies between 2 Hz and 10 kHz 10 V for frequencies above 10 kHz Other ranges: 300 V for frequencies between 2 Hz and 12 MHz
Max. permissible voltage (all ranges)	Between Hi and Lo 400 Vd.c. Between Lo and housing 500 Vd.c. or 500 V_{pp}
Common mode rejection ratio (between Lo and housing)	In the 1 mV range: Frequency 10 Hz ... 1 kHz > 140 dB 1 kHz... 10 kHz > 130 dB 10 kHz...100 kHz > 120 dB *Note: These values decrease with 10 dB/range in the higher ranges.*
Impedance between Lo and housing	1 GΩ
Output	D.c. or a.c. output (choosen by internal jumper)
D.C. output	Output resistance 1 kΩ Output voltage 1 V short-circuit proof
A.C. output	Output impedance 600 Ω in serial with 47 μF Output voltage 50 mV short-circuit proof
Accuracy d.c. output	Frequency 10 Hz – 400 kHz ± 1% of reading, ± 1% f.s.d. 2 Hz – 10 Hz ± 3% of reading, ± 1% f.s.d. 400 kHz – 2 MHz ± 2% of reading, ± 1% f.s.d. 2 MHz – 6 MHz ± 2% of reading, ± 3% f.s.d. 6 MHz – 12 MHz ± 4% of reading, ± 4% f.s.d.
Supply	Mains voltage: 90 V...132 V or 180 V...265 V, 50/60 Hz.

Long-term stability	At min. 90 operating days 1°/oo of f.s.d. on the average.

2.2. Mechanical

Dimensions	Height 145 mm Width 236 mm Depth 298 mm
Weight	Approx. 3.5 kg.

3. ACCESSORIES

3.1. Supplied as part of the equipment.

- Measuring cable for voltages above 3 mV and frequencies below 100 kHz
- Manual.

3.2. Optionally available.

- Measuring probe (10:1) PM 9336 (fig. 1 page 22)
- Measuring cable BNC–BNC PM 9074
  Length 1 m Impedance 50 Ω
- Measuring cable BNC–BNC PM 9075
  Length 1 m Impedance 75 Ω
- Measuring cable BNC–BNC PM 9076
  Length 1 m Impedance 135 Ω

4. PRINCIPLE OF OPERATION

Blockdiagram fig. 2 (page 22)

The test voltage connected to the "INPUT" socket is supplied to the input attenuator. This is a capacitively compensated and fully screened voltage divider with a proportion of 1:1 or 1000:1. The output of the attenuator is connected to the input of the impedance transformer consisting of a feedback two-stage amplifier.

The main attenuator following it is an ohmic voltage divider operating in steps of 10 dB and ensuring a constant and low impedance for the pre-amplifier

The latter consists of two amplifier stages with a high input impedance and a low output impedance.
The amplifier stage supplies the voltage for the a.c. output and the rectifier circuit, the rectifiers of which are included in the feedback network of an amplifier. The rectified current, which is proportional with the input voltage, flows through a test resistor.

The voltage drop across this resistor is measured differentially by means of a d.c. amplifier supplying the current for the test instrument. This amplifier also supplies the voltage for the d.c. output.

A reference voltage supplied by a calibrating-voltage generator.
With the aid of this voltage the unit can be calibrated in the 100 mV range. Furthermore this voltage renders it possible to adjust the attenuator probe; this should be done in the 10 mV range. The unit can be fed from the mains.
The equipment power supply voltage is stabilized to ensure that variations in mains supply voltage do not influence the display.

5. INSTALLATIONS

Before any other connection is made, the protective earth terminal shall be connected to a protective conductor (see section: EARTHING).

5.1. Mains supply and fuse

Before inserting the mains plug into a mains socket, make sure that the instrument is set to local mains voltage. The instrument is wired for operation from a 180 V...265 V, 50/60 Hz mains voltage.

5.1.1. Adapting of the mains voltage

Adaption of the instrument for other mains voltages is possible by altering the wiring of the mains transformer (see fig. 3 page 26)

To adapt the mains voltage proceed as follows:

- Remove the top cover by removing the two screws A (see fig. 5 page 26)
- Change the wiring of the transformer according to figure 3 page 26

The PM 2554 is suitable for mains voltages of 90 V...132 V and 180 V...265 V, 50/60 Hz.

5.2. Fuse

Make sure that only fuses with the required current rating and of the specified types are used. The use of repaired fuses and the short-circuiting of fuse holders is prohibited

The rating of the mains fuse of the instrument should be: 50 mA d.a. for 180 V...265 V
100 mA d.a. for 90 V...132 V

5.3. Earthing

The instrument should be connected to a protective earth in accordance with the local safety regulation. This can be effected via the 3-core mains lead. The mains plug should only be inserted in a socket outlet provided with a protective contact, the protective action of which is not cancelled by the use of an extension card or device without protective conductor.

5.4. Rackmounting

The PM 2554 can be mounted in a 19" rack by using a mounting-set as shown in fig. 22 page 27. This set is not delivered by Philips.

6. OPERATION

6.1. Mechanical zerosetting

- Place the meter in a horzontal position and check the zero-setting of the meter.
- If necessary correct the setting by means of plastic screw "A", fig. 4 (page 26)

6.2. Switching on

The instrument is ready for use after connection to the mains and earthing.
It is switched on by means of switch POWER ON (S 2).
A warming-up time of approximately 30 min. should be observed to obtain full accuracy.

6.3. Calibration

6.3.1. Instrument

- Select measuring range 100 mV
- Put the signal lead (Hi) to the connector X4 at the rear
- Adjust the meter to 100 scale divisions with potentiometer "CAL" (R 80).

6.3.2. Measuring probe PM 9336

- Before adjusting, the instrument should be calibrated as described above
- Select measuring range 10 mV
- Put the signal lead (Hi) to the connector X4 at the rear
- Adjust the probe by means of adjusting screw "A", fig. 1 (page 22).

6.4. Measuring

- Select the correct measuring range with range selector S 101
- Connect the test voltage to coaxial socket "INPUT" (X1) with the delivered measuring cable.

Notes:

- *By means of the 10:1 measuring probe PM 9336 the input impedance can be increased from 1 MΩ//30 pF (except capacity of the cable: 100 pF) to 10 MΩ//11 pF.*
  This permits of carrying out measurements on very high-ohmic circuits.
- *Do not use the delivered measuring cable for measuring voltages below 3 mV, and/or with a frequency above 100 kHz.*
- *In case of measurements of voltages in the lowest range, (1 mV) or with high frequencies (above 1 MHz) it may occur that h.f. interference signals respectively the standing wave ratio will influence the results.*
  Therefore it is advised to shield the measurements circuit.
- *For measurements at low frequencies, switch SLOW-FAST (S 102) should be set in position SLOW to obtain a proper reading.*
  As a result the indicating speed of the meter will be reduced and the pointer deflection will become more stable.

6.5. Output (X2 and X3)

The instrument is provided with a floating output.
The Lo is directly connected to the shield of the "INPUT" connector X1.
By means of an internal jumper or a d.c. output or an a.c. output is selected.
(see fig. 16 page 42).

6.5.1. D.C. output

The output voltage is proportional to the input voltage and is 1 V at full scale deflection, irrespective of the selected measuring range.
The output resistance is approx. 1 kΩ.

6.5.2. A.C. output

The output voltage is proportional to the input voltage and is 50 mV at full scale deflection, irrespective of the selected measuring range.
The output impedance is approx. 600 Ω in serial with 47 μF.

6.6. Errors due to disortion.

Although the meter indicates the mean value of the full-wave rectified voltage, the scale of the instrument is calibrated in rms values of sinewave voltages. As a result measuring errors will arise when measuring non-sinusoidal voltage.

The values of these depend on the coëfficient of non-lineair distortion.

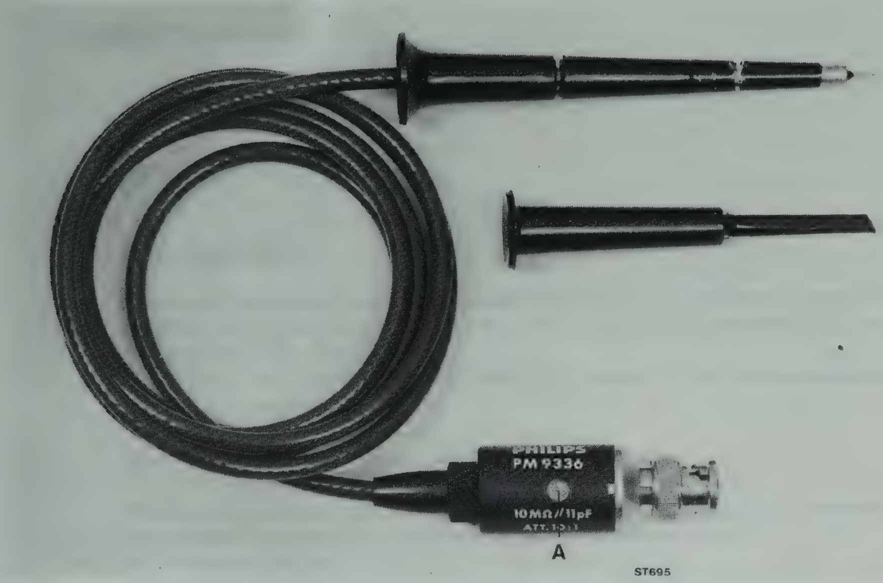

PHILIPS
PM 9336
10MΩ//11pF
ATT 10:1
A
ST695

Fig. 1.

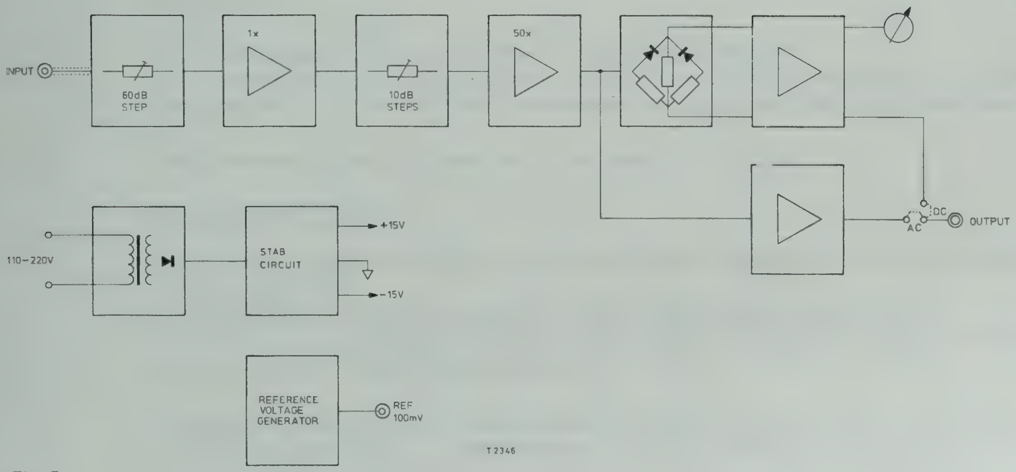

INPUT
60dB
STEP
1x
10dB
STEPS
50x
DC
AC
OUTPUT
110–220V
STAB
CIRCUIT
+15V
−15V
REFERENCE
VOLTAGE
GENERATOR
REF
100mV
T 2346

Fig. 2.

7. CIRCUIT DESCRIPTION

7.1. Measuring section

Input circuit, fig. 6

The test voltage connected to X1 is supplied to the impedance transformer stage via C1 and S 101/1f and S 101/2r (direct input) or via S 101/1f; R1...R4; C4...C6; C50...C56 and S 101/2r (via high ohmic, frequency-independent 1000:1 attenuator).
In both cases the input capacitance is equalised by means of C3, so that a possible probe (PM 9336) can be used in every test area.

Impedance transformation circuit, fig. 7

This circuit consists of a two-stage amplifier V5 and V6, the output signal of which is fully fed back.
Thus a stable single amplifier with a low output impedance is obtained.

For the protection of the field effect transistor V5 two protective diodes V2 and V4 are provided which in the reverse direction are connected between the input and V1 and V3 respectively.
If the input voltage exceeds the zener voltage of V1,or V2 or V4 will become conductive, as a result of which the voltage on the gate of V5 is limited.
The current through the diodes is limited by the impedance of the input circuit R 106–R 7 and C8. In the voltage divider that follows now and that consists of S 101/3r, R 119...R 126 and R 128...R 132 the test voltage is attenuated in steps of 10 dB. C 118 and C 119 prevent the frequency-response curve from rising.

Amplifier, fig. 8

This consists of two feedback circuits, viz. V7 with V8 and V9 with V10.
A d.c. feedback from nodal point R40 and R41 via R31 to the base of V7 is wired across the whole assembly.
The amplification of the first circuit is determined by R34 and R35 and that of the second circuit by R38 and R37.
The RC network R33 and C22 blocks oscillations from the first circuit.

AC–DC converter, fig. 9, 10

This converter contains the amplifier stages V12 and V15 with V16 coupled by the emitter-follower V14 and the current source V18.
Test resistor R65 is included in the feedback network together with the rectifier circuit.
V15 and V16 together constitute an amplifier stage in cascode arrangement. Thus feedback from the output signal to the input of this amplifier stage is avoided.

By means of a differential amplifier A2 the operating point of V16 compared with the voltage obtained from voltage divider R58 – R59. A possible deviating voltage is amplified and fed back to the base of V12 so that the voltage is corrected. The voltage on the collector of V16 has been chosen so that it is equal to the emitter voltage plus half the knee voltage of V19 and V20; consequently the latter diodes can never become conductive on account of a voltage difference between the collector of V16 and the emitter of V12.
To prevent the a.c. signal from the collector of V16 from being fed back to the base of V12 via the differential amplifier, C33 has been applied across this amplifier. As a result of this the variable-gain amplifier behaves as an integrator with a time constant governed by C33 and R56. The property of this integrator is that it passes on signal with frequencies below $f = \frac{1}{2\pi . RC}$ after amplification, but attenuates signals strongly if their frequency is higher.

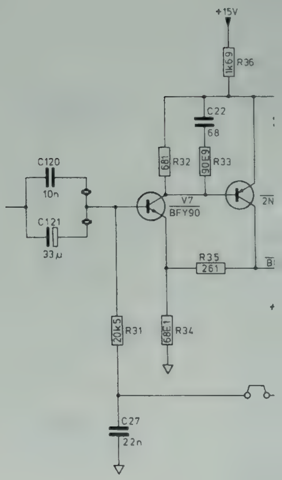


Fig. 8. AC Amplifier

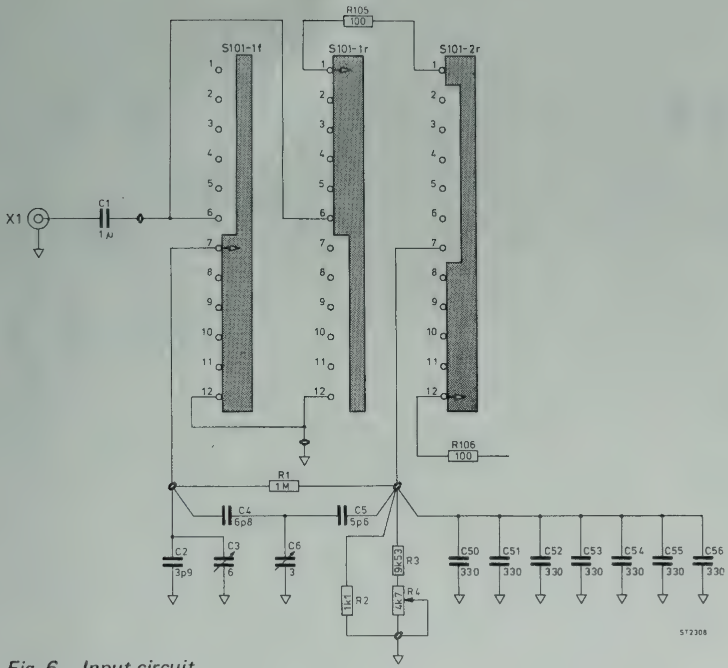


Fig. 6. Input circuit.

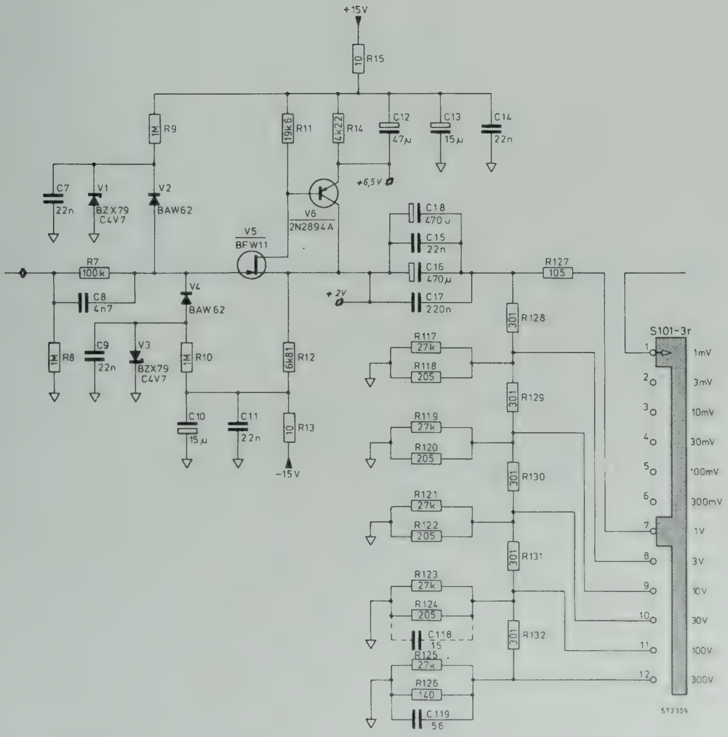
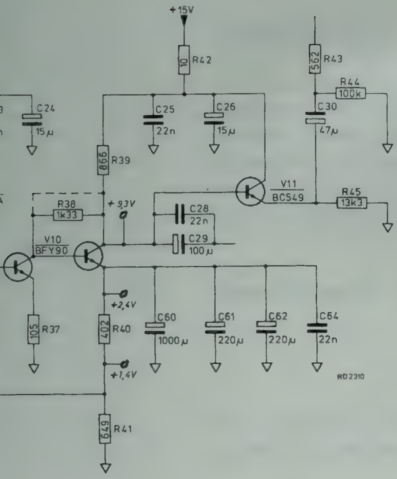


Fig. 7. Impedance transformation circuit



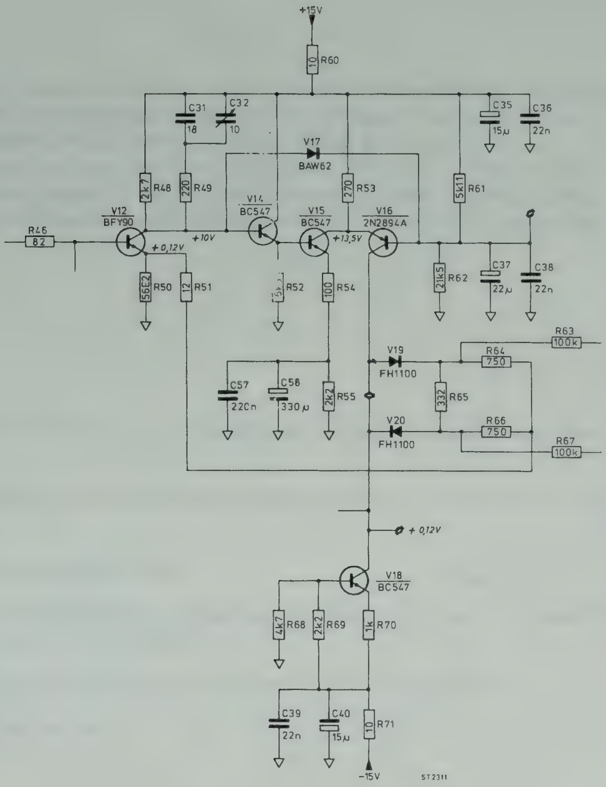


Fig. 9. AC - DC Converter

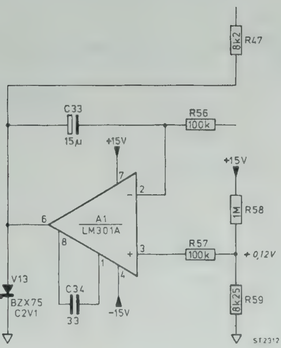


Fig. 10. Feedback circuit

DC amplifier, fig. 11

The dc voltage which appears over the measuring resistor R65 is fed via resistors R63 and R67 which, together with the resistors R27 and R73 determine the amplification factor (X1) for dc signals. The ripple voltage at the output of the amplifier A2 is suppressed by the capacitors C45 and C42 and the resistor R73.
Owing to the circuit arrangement by which capacitors C45 and 42 can be switched using S 102 the ripple suppression is also effective at very low frequencies. At the same time the meter response is damped so that unwanted virbration of the meter needle is reduced. The offset voltage for A2 is determined by resistor R91.

7.2. Supply section, fig. 12

The two primary windings S1 and S2 of transformer T1 can be connected in series or in parallel by connecting together the appropriate soldering pins.

For mains voltages between 180 and 265 volts the windings must be connected in series and for voltages between 90 and 132 volts in parallel.

The output of T1 is rectified by V21 and smoothed by C46.

The current source consisting of V23–26 and R84 delivers the current for the equipment and at the same time provides a stabilized supply voltage via zener diodes V24 and V25.

The adjusting current for V23 is delivered by the current source consisting of V22–25 and R83.

R82 is the starting resistor for both current sources.

7.3. Reference voltage generator, fig. 13

The generator consists of a CMOS circuit with a time constant determined by R85 and C47. The supply voltage for this circuit is further stabilized by means of zener diode V27, resulting in the square wave at the output (pin 10) being extremely stable.

This voltage is applied to a potential divider consisting of resistors R86 to 89 and a proportion of it is applied to reference output X4.
Applying this voltage to the 100 mV range enables the instrument to be calibrated.

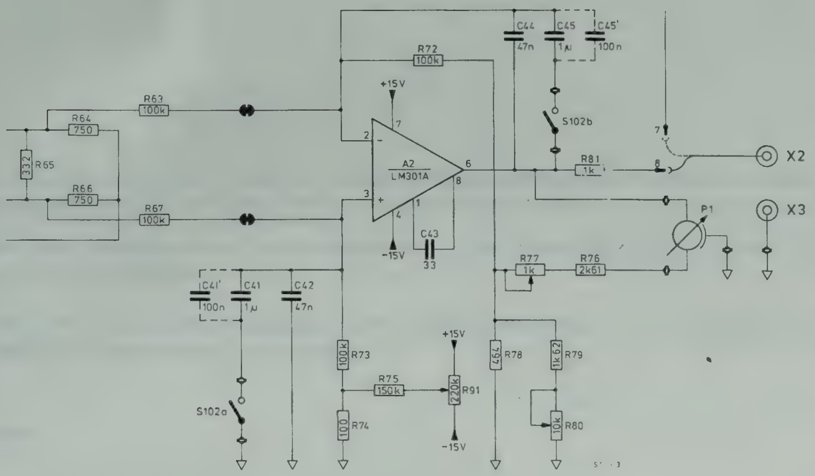


Fig. 11. DC Amplifier

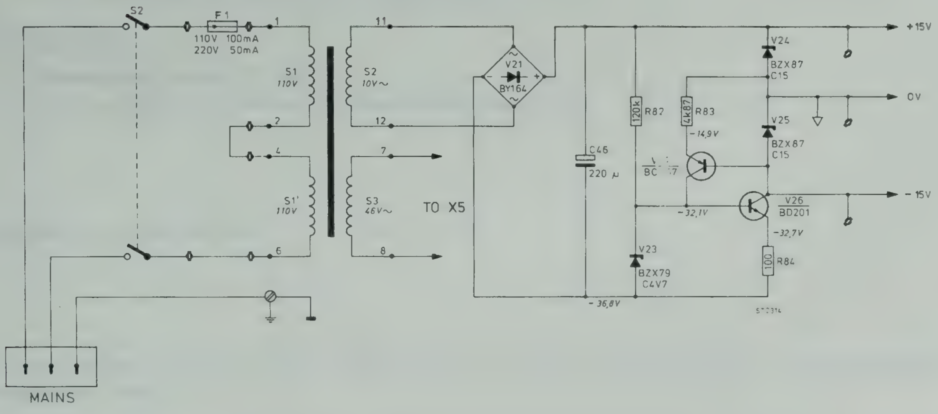


Fig. 12. Mains section

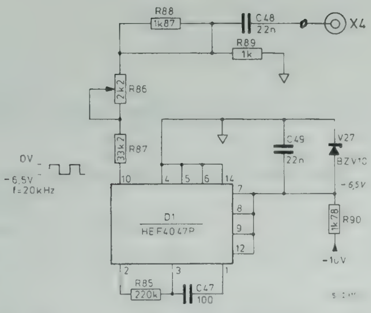


Fig. 13. Reference voltage generator

8. ACCESS

The opening of parts, or removal of covers, is likely to expose live conductors. The instrument should therefore be disconnected from all voltage sources before any opening of parts or removal of covers is started.

During and after dismantling, bear in mind that capacitors in the instrument may still be charged even if it has been separated from all voltage sources.

USE A WELL-FITTING CROSSHEAD SCREW-DRIVER TO DISMANTLE THE INSTRUMENT TO PREVENT THE CORSS-SLOTTED SCREWS FOR DAMAGE.

8.1. Dismantling

1. Top cover
   - Remove both screws "A" (fig. 5)
   - Lift the cover at the rear and slide it backwards from the unit.
2. Bottom cover
   - Remove both screws "B" (fig. 5)
   - Lift the cover at the rear and slide it backwards from the unit.

9. MAINTENANCE AND SERVICING

AC millivoltmeter PM 2554 requires no maintenance because the instrument contains no components which are subject to wear.

However, to ensure reliable and faultless operation, the instrument should not be exposed to moisture, heat, corrosive vapours and excessive dust.

9.1. Service hints

If service work must be performed, the following points should be taken into account to avoid damage of the instrument.

- In case of measurements on a switched-on instrument proceed carefully to avoid short-circuits by means of measuring clips or measuring hooks.
- For soldering use absolutely acid-free soldering tin.
- For all soldering work on the printed circuit boards, use a miniature soldering iron (35 W max.) with a thin-cleaner or a vacuum soldering iron.
- On the printed wiring boards jumpers are introduced at the conductor side; they can be used to interrupt circuits in order to test the functioning of the corresponding circuit.
- The dc settings of the instrument given on the circuit diagram are measured with the input short circuited. These values represent an average instrument.

10. CHECKING AND ADJUSTING

10.1. General

The tolerances stated in this chapter correspond to the factory data; they apply when the instrument is readjusted completely. Such data may differ from these given in chapter 2. Technical Data.

To calibrate this instrument,only reference voltages and measuring equipment with the required accuracy should be applied.

Before calibration, a warming-up time of approximately 30 minutes should be taken into account.

10.2. Survey of adjusting elements

The next table gives a survey of the adjustments and checking procedure.

For a complete adjustment adhere to the sequence of point 3 of this chapter.

Adjusting unit	Fig.	Adjustment or final adjustment	Required measuring or auxiliary instrument	Adjust according to chapter 10 sub-point
R80	18	Calibrating the instrument		3.4
R4	19	Frequency-independent voltage divider	LF generator precision LF millivoltmeter	3.5
R91	18	Zero point DC amplifier	Voltmeter, for instance PM 2403	3.3
R77	18	DC output	LF generator, precision LF millivoltmeter. Voltmeter, for instance PM 2421	3.4
R86	18	Reference voltage	LF generator, precision LF millivoltmeter	3.6
C3/C6	18	Frequency-independent voltage divider	LF generator, precision LF millivoltmeter. Probe PM 9333	3.5

10.3 Adjusting procedure

10.3.1. Mechanical zero-setting

- Check with the unit switched off whether the mechanical zero adjustment of the pointer is correct. Deviations can be corrected by means of the correction screw. The unit should be placed horizontal in this case.

10.3.2. Supply voltages

- The value adjusted by means of the wiring of T1 (see fig. 3) must correspond with the local mains voltage
- The mains fuse must have a current value of 50 mA d.a. (90 V...132 V) or 100 mA d.a. (180 V...265 V)
- The supply voltages are + 15 V and – 15 V with respect to 0

  Test points + 15 V: cathode V24
  0 V: cathode V25
  – 15 V: anode V25

10.3.3. Zero-setting d.c. amplifier

- Set S 101 to position 300 mV
- Measure the voltage on the d.c. output
- Adjust this voltage to 0 V by means of potentiometer R91
- Set S 101 to position 1 mV
- The pre-deflection must be less than 3 scale devisions (sd.)

10.3.4. Adjusting the d.c. output

- Set S 101 to position 30 mV
- Connect a voltage of 31.6 mV ± 0.2%; 1 kHz to X1
- Adjust the test system to 100 sd by means of R80
- Measure the voltage on the d.c. output X2 and X3
- Adjust the voltage to 1 V ± 0.2% by means of R77

10.3.5. Adjusting the frequency-independent voltage divider

- Set S 101 to position 10 V
- Connect a voltage of 10 V ± 0.2% 400 Hz to X1
- Adjust the test system to 100 sd by means of R4
- Increase the frequency to 50 kHz
- Adjust the test system to 100 sd by means of C6
- Set S 101 to position 100 mV
- Connect a voltage of 1 V ± 0.2% to X1 via a PM 9336 probe
- Note down the deflection of the test system.
- Increase the frequency to 50 kHz
- Adjust the system to the value noted by means of the trimming potentiometer in the probe
- Set S 101 to position 1 V
- Connect a voltage of 10 V ± 0.2%, 200 Hz to X1 via the probe now adjusted
- Noted down the deflection of the test system
- Increase the frequency to 50 kHz
- Adjust the system to the latter value by means of C3.

10.3.6. Adjusting the reference generator

- Set S 101 in position 100 mV
- Apply a voltage of 100 mV ± 0.2% 1 kHz to X1
- Adjust the test system to 100 sd by means of R80
- Interconnect X1 and X4
- Adjust the test system to 100 sd by means of R86

10.3.7. Ripple suppression

(Only necessary if C41 or C45 has to be replaced)

- Set S 101 in position 1 V
- Set S 102 in position slow
- Connect a voltage of 0.9 V 2 Hz to X1
- The total swing of the needle should be smaller than 0.5 sd
- If necessary add a capacitor of 0.1 μF in parallel with R41 or R45

10.3.8. Final check

After the above adjustments, the instrument must comply with the specifications given in the table below.

Position S 101	Supply			Indication in sd test system	D.C. Output
10 mV	10	mV	10 kHz	100 ± 1.5%	1 V ± 1.5%
30 mV	31.6	mV	10 kHz	100 ± 1.5%	1 V ± 1.5%
100 mV	100	mV	10 kHz	100 ± 1.5%	1 V ± 1.5%
100 mV	100	mV	400 kHz	100 ± 1.5%	1 V ± 1.5%
100 mV	100	mV	10 Hz	100 ± 1.5%	1 V ± 1.5%
100 mV	100	mV	2 Hz	100 ± 3.5%	1 V ± 3.5%
100 mV	100	mV	2 MHz	100 ± 2 %	1 V ± 2.5%
100 mV	100	mV	6 MHz	100 ± 4 %	1 V ± 4 %
100 mV	100	mV	12 MHz	100 ± 7 %	1 V ± 7 %
1 V	1	V	10 kHz	100 ± 1.5%	1 V ± 1.5%
1 V	1	V	12 MHz	100 ± 7 %	1 V ± 7 %
3 V	3.16	V	10 kHz	100 ± 1.5%	1 V ± 1.5%
10 V	10	V	10 kHz	100 ± 1.5%	1 V ± 1.5%

Note:— Accuracy of the voltage supplied: + 0.5%
— In case of a to high indication at 2 Hz C60 should be increased or C16 should be decreased.

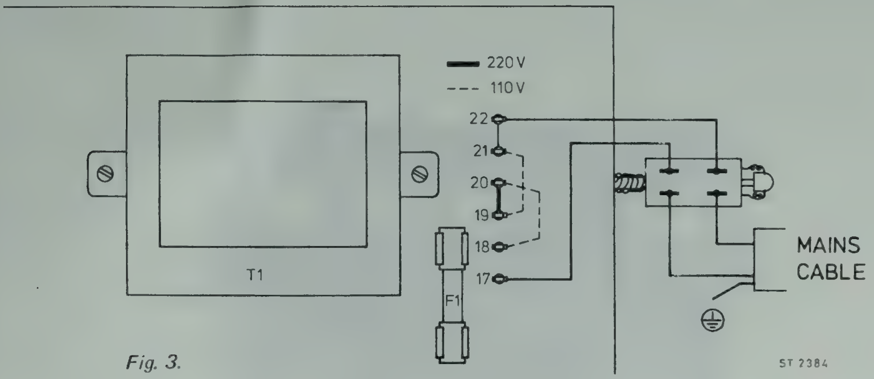

220 V
110 V
22
21
20
19
18
17
T1
F1
MAINS CABLE
ST 2384

Fig. 3.

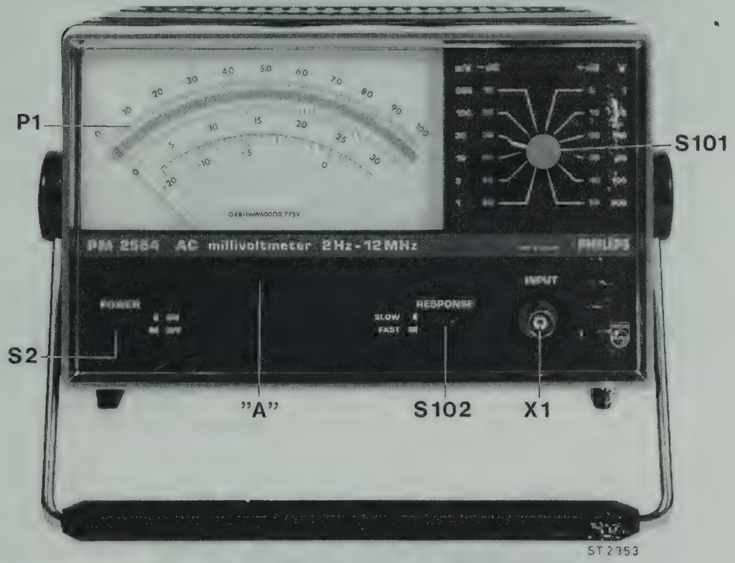
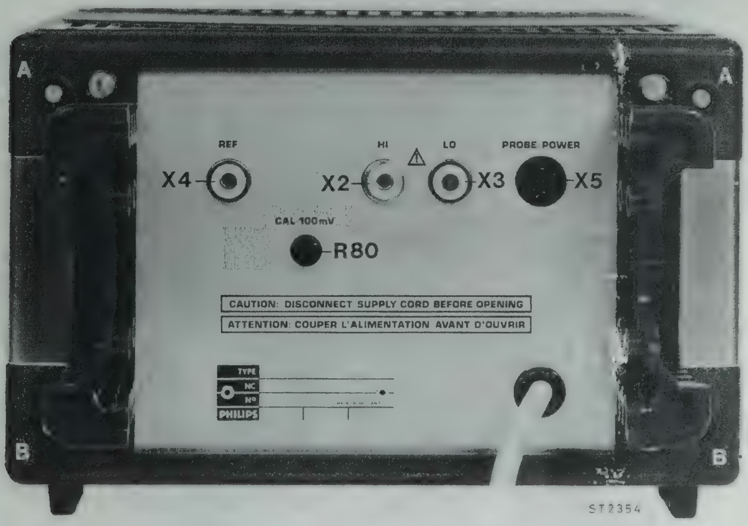

P1
S101
S2
"A"
S102
X1
PM 2554 AC millivoltmeter 2 Hz - 12 MHz
PHILIPS
POWER
ON
OFF
RESPONSE
SLOW
FAST
INPUT
ST 2353

Fig. 4.


A
A
REF
HI
LO
PROBE POWER
X4
X2
X3
X5
CAL 100mV
R80
CAUTION: DISCONNECT SUPPLY CORD BEFORE OPENING
ATTENTION: COUPER L'ALIMENTATION AVANT D'OUVRIR
TYPE
NC
No
PHILIPS
B
B
ST 2354

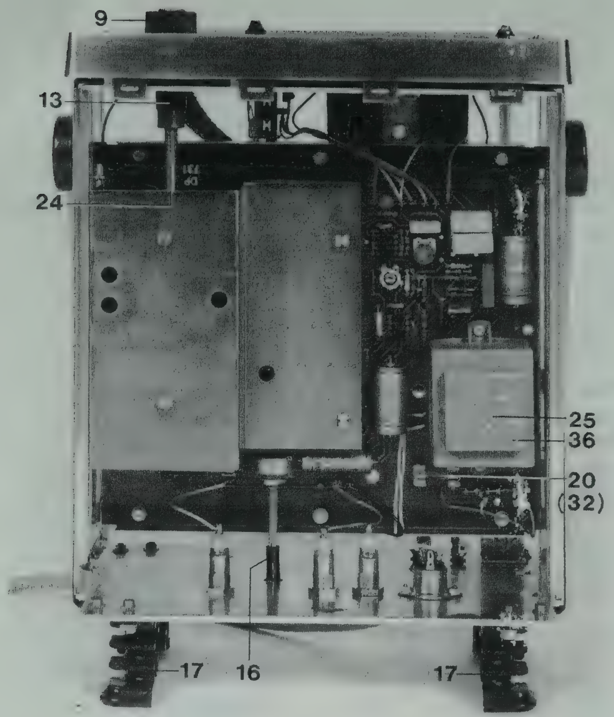
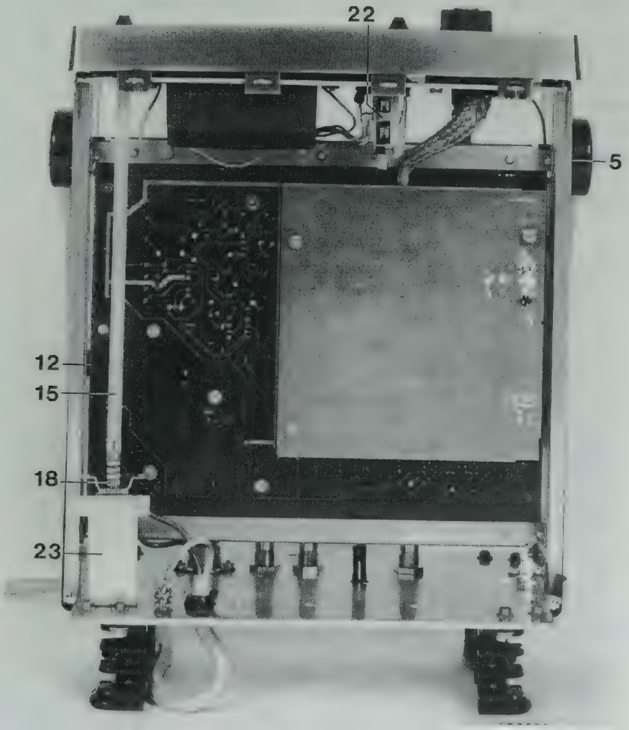


Fig. 16. Top view



11.3. Electrical

11.3.1. Resistors *

No.	Ordering number	Value (Ω)	%	Series
R 1	5322 116 54188	1 M	1	MR30
R 2	5322 116 54554	1,1 k	1	MR25
R 3	5322 116 54617	9,53 k	1	MR25
R 4	4822 101 20416	4,7 k	20	0.1W Potentiometer
R 7	4822 116 51123	100 k	1	MR30
R 8	5322 116 54188	1 M	1	MR30
R 11	5322 116 54641	19,6 k	1	MR25
R 12	5322 116 54012	6,81 k	1	MR25
R 13	5322 116 50452	10	1	MR25
R 14	5322 116 50729	4,22 k	1	MR25
R 15	5322 116 50452	10	1	MR25
R 31	5322 116 54643	20,5 k	1	MR25
R 32	5322 116 54534	681	1	MR25
R 33	5322 116 54466	90,9	1	MR25
R 34	5322 116 54455	68,1	1	MR25
R 35	5322 116 54502	261	1	MR25
R 36	5322 116 54567	1,69 k	1	MR25
R 37	5322 116 54472	105	1	MR25
R 38	5322 116 54561	1,33 k	1	MR25
R 39	5322 116 54543	866	1	MR25
R 40	5322 116 54519	402	1	MR25
R 41	5322 116 54532	649	1	MR25
R 42	5322 116 50452	10	1	MR25
R 43	5322 116 54009	562	1	MR25
R 44	5322 116 54696	100 k	1	MR25
R 45	5322 116 54627	13,3 k	1	MR25
R 50	5322 116 54446	56,2	1	MR25
R 57	5322 116 54696	100 k	1	MR25
R 58	5322 116 54188	1 M	1	MR30
R 59	5322 116 54558	8,25 k	1	MR25
R 61	5322 116 54595	5,11 k	1	MR25
R 62	5322 116 50451	21,5 k	1	MR25
R 63	5322 116 54696	100 k	1	MR25
R 64	5322 116 54536	750	1	MR25
R 65	5322 116 54513	332	1	MR25
R 66	5322 116 54536	750	1	MR25
R 67	5322 116 54696	100 k	1	MR25
R 72	5322 116 54696	100 k	1	MR25
R 73	5322 116 54696	100 k	1	MR25
R 74	5322 116 54469	100	1	MR25

* Carbon resistors CR25 5% –0,125 W are not mentioned in this list

No.	Ordering number	Value (Ω)	%	Series	
R 76	5322 116 50671	2,61 k	1	MR25	
R 77	4822 100 10037	1 k	20	0,05W	Potentiometer
R 78	5322 116 50536	464	1	MR25	
R 79	5322 116 54565	1,62 k	1	MR25	
R 80	5322 101 24138	10 k	20	MR25	
R 81	5322 116 54549	1 k	1	MR25	
R 83	5322 116 50509	4,87 k	1	MR25	
R 84	5322 116 54469	100	1	MR25	
R 86	4822 100 10029	2,2 k	20	0,05W	Potentiometer
R 87	5322 116 50482	33,2 k	1	MR25	
R 88	5322 116 50728	1,87 k	1	MR25	
R 89	5322 116 54549	1 k	1	MR25	
R 90	5322 116 50729	4,22 k	1	MR25	
R 91	4822 100 10088	220 k	20	0,05W	Potentiometer
R 105	5322 116 54852	100	1	MR30	
R 106	5322 116 54852	100	1	MR30	
R 118	5322 116 54767	205	0,25	MR24C	
R 120	5322 116 54767	205	0,25	MR24C	
R 122	5322 116 54767	205	0,25	MR24C	
R 123	4822 110 63145	27 k	5	CR25	
R 124	5322 116 54767	205	0,25	MR24C	
R 126	5322 116 50865	140	0,25	MR24C	
R 127	5322 116 54472	105	1	MR25	
R 128	5322 116 55038	301	0,25	MR24C	
R 129	5322 116 55038	301	0,25	MR24C	
R 130	5322 116 55038	301	0,25	MR24C	
R 313	5322 116 55038	301	0,25	MR24C	
R 132	5322 116 55038	301	0,25	MR24C	

11.3.2. Capacitors

No.	Ordering number	Value (F)	%	V	Description
C 1	4822 121 40117	1 μ	10	400	Polyester
C 2	4822 122 31217	3,9 p	0,25pF		Ceramic
C 3	4822 125 60037	6		500	Trimmer
C 4	4822 122 31192	6,8 p	0,25pF	500	Ceramic
C 5	4822 122 31191	5,6 p	0,25pF	500	Ceramic
C 6	5322 125 64011	3 p		500	Trimmer
C 7	4822 122 30103	22 n	–20+80	40	Ceramic
C 8	5322 121 44225	4,7 n	10	630	Polyester
C 9	4822 122 30103	22 n	–20+80	40	Ceramic
C 10	4822 124 20467	15 μ	–10+50	16	Electrolytic
C 11	4822 122 30103	22 n	–20+80	40	Ceramic
C 12	4822 124 20461	47 μ	–10+50	10	Electrolytic
C 13	4822 124 20467	15 μ	–10+50	16	Electrolytic
C 14	4822 122 30103	22 n	–20+80	40	Ceramic
C 15	4822 122 30103	22 n	–20+80	40	Ceramic
C 16	4822 124 20457	470 μ	–10+50	6,3	Electrolytic
C 17	4822 121 40232	220 n	10	100	Polyester
C 18	4822 124 20457	470 μ	–10+50	6,3	Electrolytic
C 22	4822 122 31076	68 p	2	100	Ceramic
C 23	4822 122 30103	22 n	–20+80	40	Ceramic
C 24	4822 124 20467	15 μ	–10+50	16	Electrolytic
C 25	4822 122 30103	22 n	–20+80	40	Ceramic
C 26	4822 124 20467	15 μ	–10+50	16	Electrolytic
C 27	4822 122 30103	22 n	–20+80	40	Ceramic
C 28	4822 122 30103	22 n	–20+80	40	Ceramic
C 29	4822 124 20462	100 μ	–10+50	10	Electrolytic
C 30	4822 124 20461	47 μ	–10+50	10	Electrolytic
C 31	4822 122 31061	18 p	2	100	Ceramic
C 32	4822 125 50062	10 p		250	Trimmer
C 33	4822 124 20467	15 μ	–10+50	16	Electrolytic
C 34	4822 122 31067	33 p	2	100	Ceramic
C 35	4822 124 20467	15 μ	–10+50	16	Electrolytic
C 36	4822 122 30103	22 n	–20+80	40	Ceramic
C 37	4822 124 20459	22 μ	–10+50	10	Electrolytic
C 38	5322 121 40308				Polyester
C 39	4822 122 30103	22 n	–20+80	40	Ceramic
C 40	4822 124 20467	15 μ	–10+50	16	Electrolytic
C 41	5322 121 40197	1 μ	10	100	Polyester
C 42	5322 121 44138	47 n	10	100	Polyester
C 43	4822 122 31067	33 p	2	100	Ceramic
C 44	5322 121 44138	47 n	10	100	Polyester
C 45	5322 121 40197	1 μ	10	100	Polyester
C 46	4822 124 20537	220 μ	–10+50	63	Electrolytic
C 47	4822 122 31081	100 p	2	100	Ceramic
C 48	4822 122 30103	22 n	–20+80	40	Ceramic

No.	Ordering number	Value (F)		%	V	Description
C 49	4822 122 30103	22	n	−20+80	40	Ceramic
C 50	4822 122 30055	330	p	−20+80	100	Ceramic
C 51	4822 122 30055	330	p	2	100	Ceramic
C 52	4822 122 30055	330	p	2	100	Ceramic
C 53	4822 122 30055	330	p	2	100	Ceramic
C 54	4822 122 30055	330	p	2	100	Ceramic
C 55	4822 122 30055	330	p	2	100	Ceramic
C 56	4822 122 30055	330	p	2	100	Ceramic
C 57	4822 121 40232	220	n	10	100	Polyester
C 58	4822 124 20465	330	µ	−10+50	10	Electrolytic
C 60	4822 124 20508	1000	µ	−10+50	4	Electrolytic
C 61	4822 124 20581	220	µ	−10+50	4	Electrolytic
C 62	4822 124 20515	2200	µ	−10+50	6,3	Electrolytic
C 64	4822 122 30103	22	n	−20+80	40	Ceramic
C 118	4822 122 31058	15	p	2	100	Ceramic
C 119	4822 122 31074	56	p	2	100	Ceramic
C 121	4822 124 20468	33	µ	−10+50	16	Electrolytic

11.3.3. Semiconductors

No.	Ordering number	Type
V 1	5322 130 34174	BZX79–C4V7
V 2	4822 130 30613	BAW62
V 3	5322 130 34174	BZX79–C4V7
V 4	4822 130 30613	BAW62
V 5	5322 130 40408	BFW11
V 6	5322 130 44127	2N2894A
V 7	5322 130 40493	BFY90
V 8	5322 130 44127	2N2894A
V 9	5322 130 40493	BFY90
V 10	5322 130 40493	BFY90
V 11	4822 130 40964	BC549
V 12	5322 130 40493	BFY90
V 13	5322 130 34049	BZX75–C2V1
V 14	4822 130 44257	BC547
V 15	4822 130 44257	BC547
V 16	5322 130 44127	2N2894A
V 17	4822 130 30613	BAW62
V 18	4822 130 44257	BC547
V 19	5322 130 34062	FH1100
V 20	5322 130 34062	FH1100
V 21	4822 130 30414	BY164
V 22	4822 130 44256	BC557
V 23	5322 130 34174	BZX79–C4V7
V 24	5322 130 34156	BZX87–C15
V 25	5322 130 34156	BZX87–C15

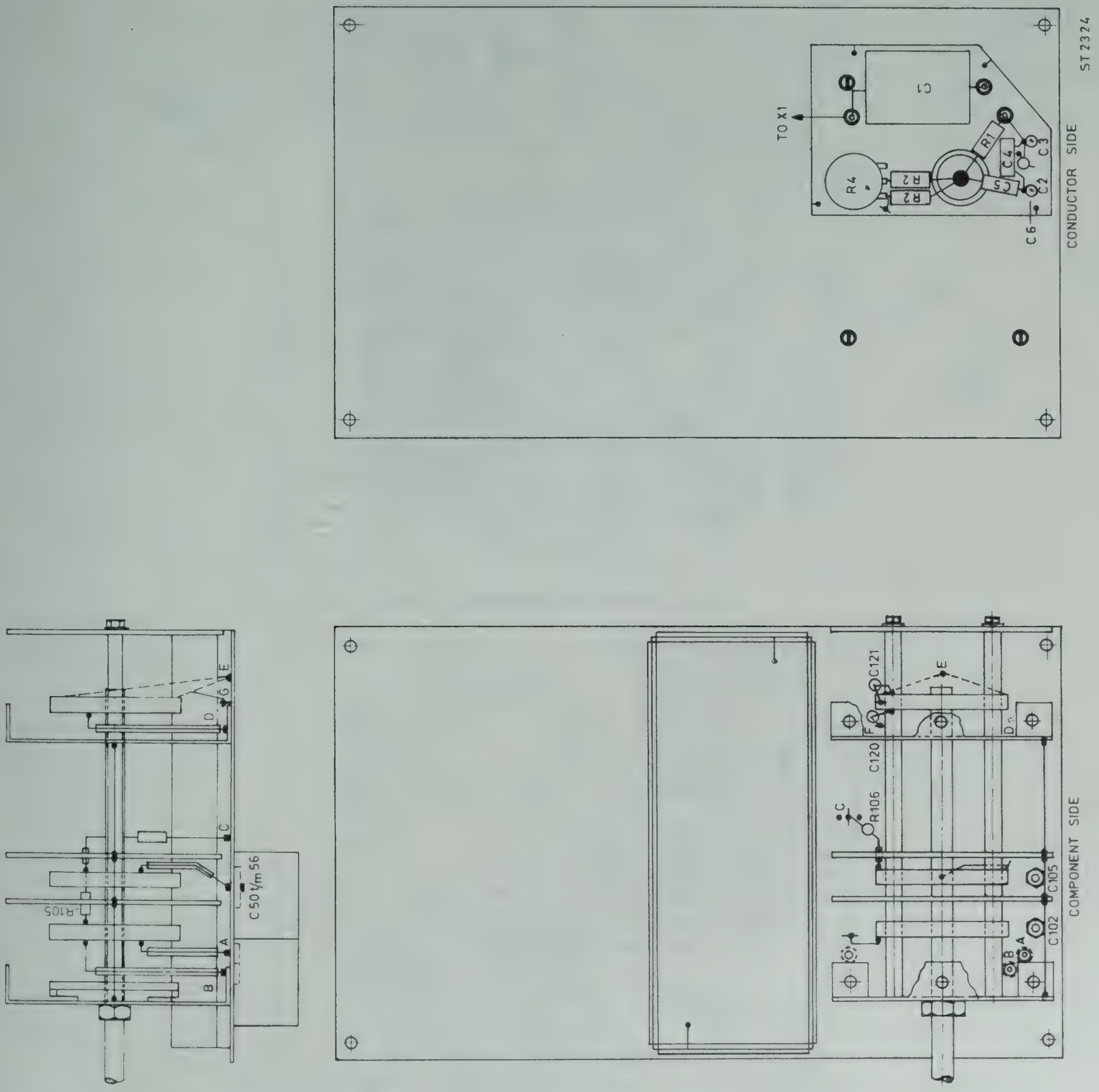


Fig. 20. Printed circuit board U1 with S 101

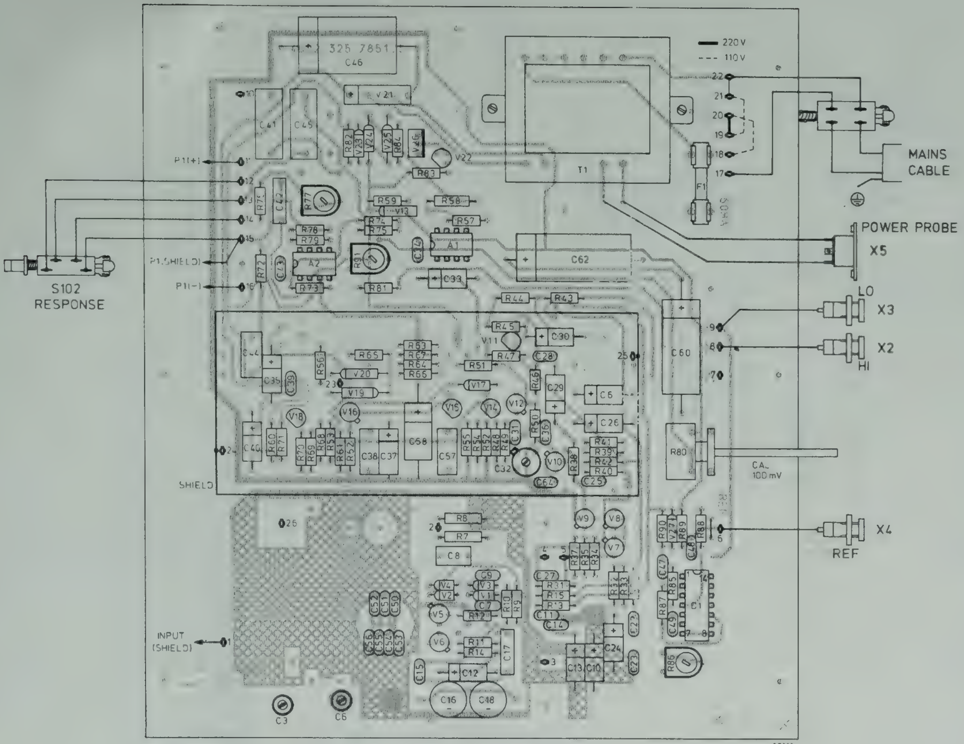
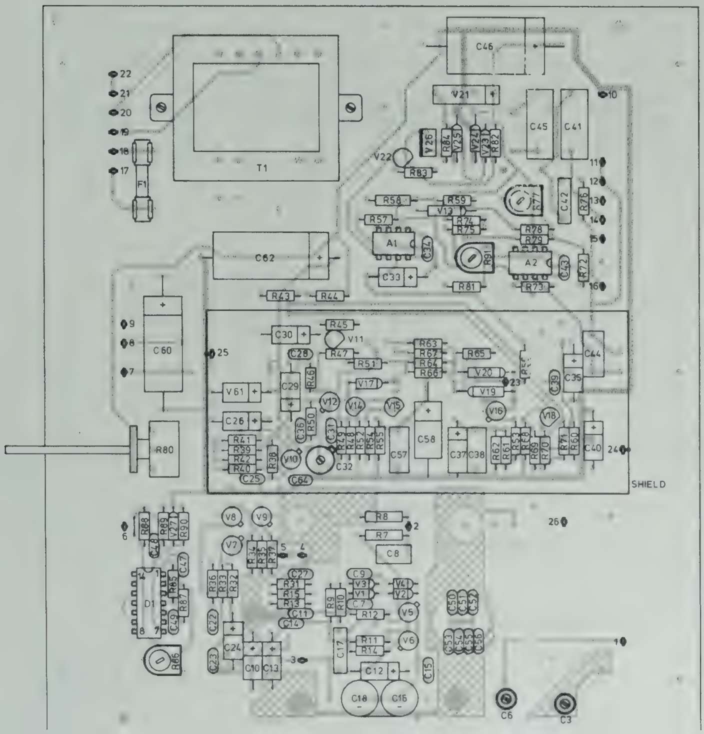
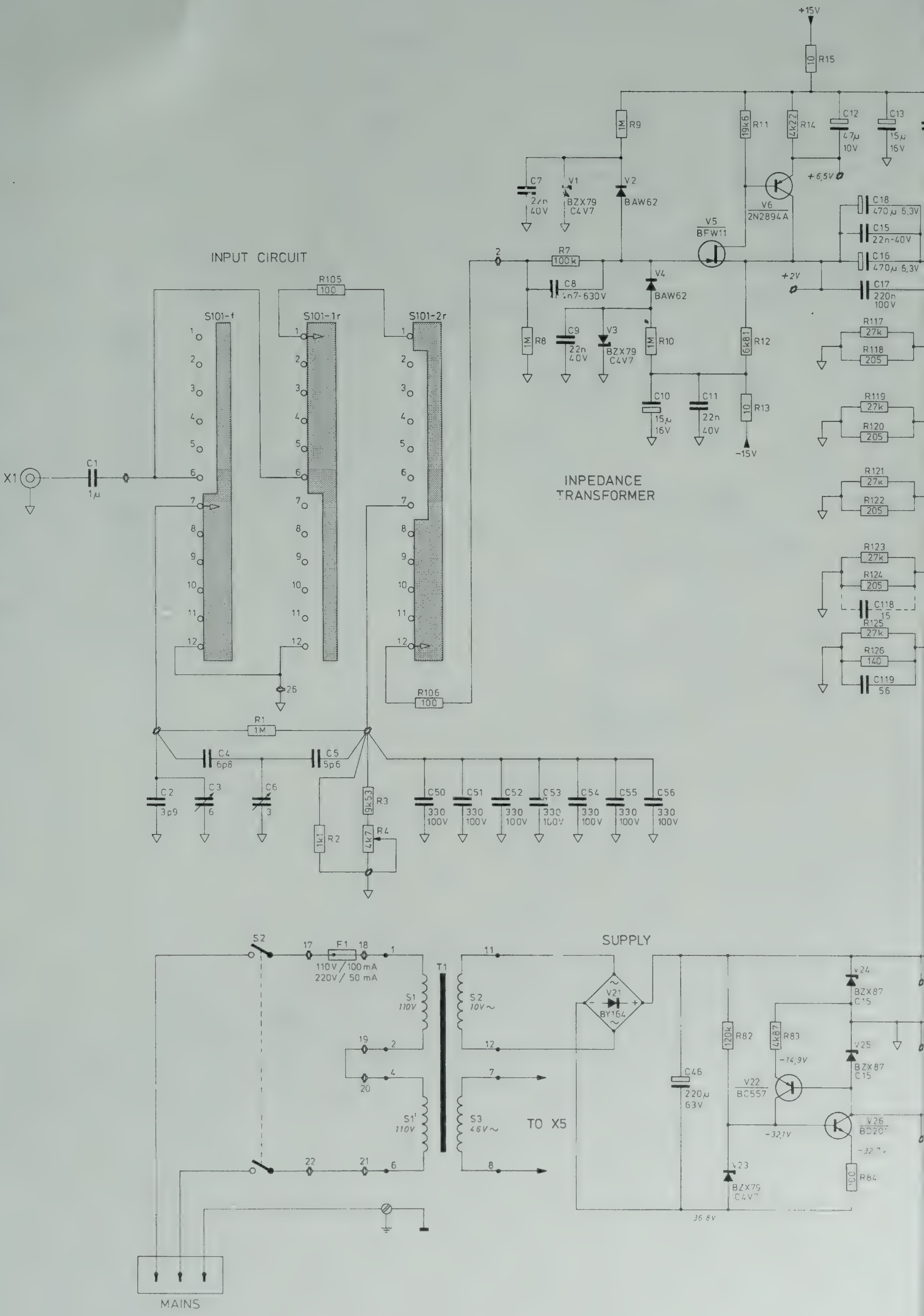
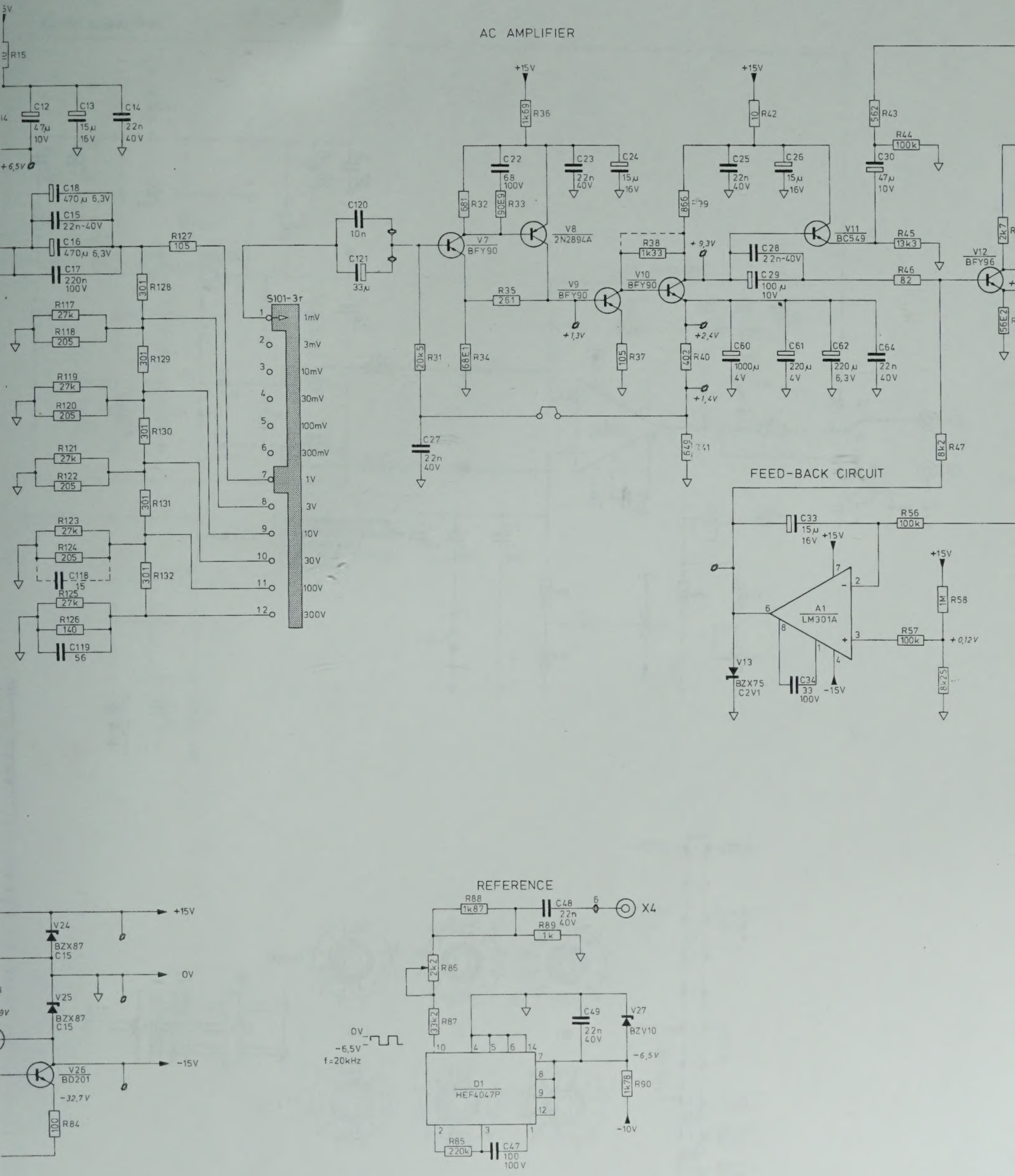


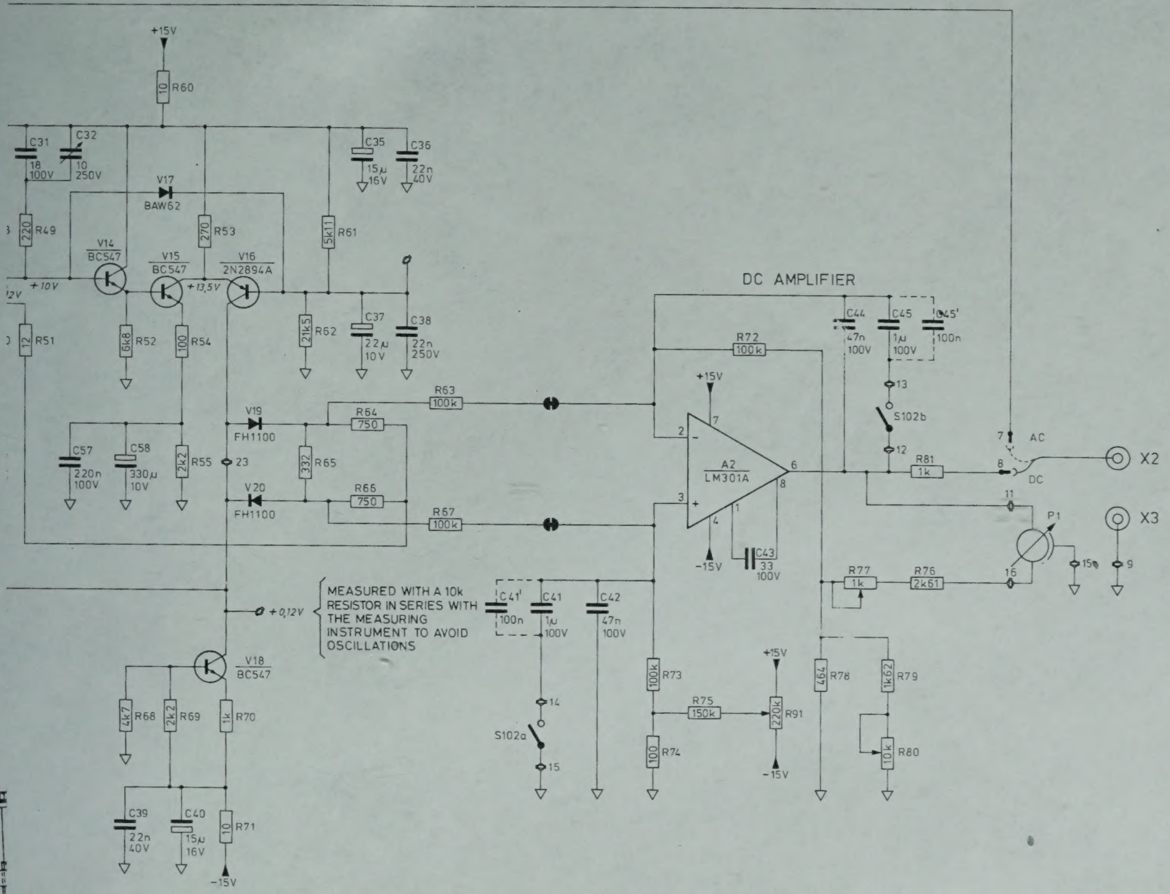
Fig. 18. Printed circuit board U1 Component side




INPUT CIRCUIT
INPEDANCE TRANSFORMER
SUPPLY
MAINS
TO X5
X1
C1 1μ
S101-f
S101-1r
S101-2r
R105 100
R106 100
R1 1M
C4 6p8
C5 5p6
C2 3p9
C3 6
C6 3
R2 1k1
R3 9k53
R4 4k7
C50 330 100V
C51 330 100V
C52 330 100V
C53 330 100V
C54 330 100V
C55 330 100V
C56 330 100V
26
+15V
-15V
R15 10
R9 1M
R11 19k6
R14 4k22
C12 47μ 10V
C13 15μ 16V
+6,5V
C7 22n 40V
V1 BZX79 C4V7
V2 BAW62
V6 2N2894A
V5 BFW11
C18 470μ 6,3V
C15 22n-40V
C16 470μ 6,3V
C17 220n 100V
+2V
R7 100k
C8 4n7-630V
V4 BAW62
R8 1M
C9 22n 40V
V3 BZX79 C4V7
R10 1M
R12 6k81
C10 15μ 16V
C11 22n 40V
R13 10
R117 27k
R118 205
R119 27k
R120 205
R121 27k
R122 205
R123 27k
R124 205
C118 15
R125 27k
R126 140
C119 56
S2
17
F1
18
110V / 100mA
220V / 50 mA
T1
S1 110V
S1' 110V
S2 10V~
S3 46V~
19
20
21
22
11
12
7
8
V21 BY164
C46 220μ 63V
R82 120k
R83 4k87
V22 BC557
-14,9V
-32,1V
V23 BZX79 C4V7
V24 BZX87 C15
V25 BZX87 C15
V26 BD201
R84 100
36,8V


AC AMPLIFIER
FEED-BACK CIRCUIT
REFERENCE
+15V
R15
C12 47µ 10V
C13 15µ 16V
C14 22n 40V
+6,5V
C18 470µ 6,3V
C15 22n-40V
C16 470µ 6,3V
C17 220n 100V
R127 105
R128 301
R129 301
R130 301
R131 301
R132 301
R117 27k
R118 205
R119 27k
R120 205
R121 27k
R122 205
R123 27k
R124 205
C118 15
R125 27k
R126 140
C119 56
S101-3r
1mV
3mV
10mV
30mV
100mV
300mV
1V
3V
10V
30V
100V
300V
C120 10n
C121 33µ
R31 20k5
C27 22n 40V
R36 1k69
C22 68 100V
R32 681
R33 90E9
V7 BFY90
V8 2N2894A
C23 22n 40V
C24 15µ 16V
R35 261
R34 68E1
V9 BFY90
+1,3V
R37 105
V10 BFY90
R38 1k33
R39 866
+9,3V
+2,4V
R40 402
+1,4V
R41 649
R42 10
C25 22n 40V
C26 15µ 16V
C28 22n-40V
C29 100µ 10V
C60 1000µ 4V
C61 220µ 4V
C62 220µ 6,3V
C64 22n 40V
V11 BC549
R43 562
R44 100k
C30 47µ 10V
R45 13k3
R46 82
V12 BFY96
2k7
56E2
R47 8k2
C33 15µ 16V
R56 100k
A1 LM301A
C34 33 100V
-15V
V13 BZX75 C2V1
R58 1M
R57 100k
+0,12V
8k25
V24 BZX87 C15
0V
V25 BZX87 C15
V26 BD201
-32,7V
R84 100
R88 1k87
C48 22n 40V
X4
R89 1k
R86 2k2
R87 33k2
C49 22n 40V
V27 BZV10
-6,5V
R90 1k78
-10V
D1 HEF4047P
R85 220k
C47 100 100V
0V
-6,5V
f=20kHz

AC-DC CONVERTER



MEASURED WITH A 10k RESISTOR IN SERIES WITH THE MEASURING INSTRUMENT TO AVOID OSCILLATIONS